PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

In this issue . . .

Blessings Out of Adversity

Crises of Conscience for Christians in Science

Comforting Job in the ICU

"The fear of the Lord is the beginning of Wisdom."
Psalm 111:10

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Putting Things in Perspective

One of the most impressive phenomena associated with the impact of disease on humans and on animals is the devastation that can result when disease strikes a previously unexposed, and hence non-immune, population. The corollary to this is that after such exposure there will be enough partially or totally immune individuals to ameliorate the effects of subsequent epidemics. In our lead paper in this issue, Stanley Rice gives us examples of adverse circumstances in the natural world and suggests similarities with God's role in human history.

Richard Bube discusses some of the problems that we face as Christians when we realize that "any increase in knowledge is potentially dangerous." Professor Bube reminds us of some of the moral dilemmas presented in research areas such as *in vitro* fertilization, the ending of life, environmental problems, and weapons research. His major warning is that we avoid the pitfall of a religious pragmatism that fails to apply biblical teaching when it seems impractical.

A specific example of such a "crisis of conscience" in the medical world is given by David Schiedermayer, MD as he describes some of the problems of high technology medicine and wonders how we would apply such "treatment" to Job. The ICU is one of many current ethical problems in which there is serious interest by both the American Scientific Affiliation and the Christian Medical and Dental Society. We need to continue our joint ventures in these areas of literally life-and-death concerns.

John Byl continues the discussion of the possibility of "accidental occurrence" of life with a reexamination of Robert Newman's proposal (*Perspectives*, March 1988). Although he criticizes Newman's evidence, he agrees that "the probability of life arising spontaneously is extremely small."

Jim Neidhardt describes the roles of reason and faith in both theology and science. Both disciplines are forms of "faith seeking understanding."

George Murphy reminds us that the pursuit of science can be hazardous to your health. Scientists have been martyrs not only because their conclusions disagreed with the prevailing ideas of their times; working with radioactivity and infectious diseases can and has killed or injured many during the course of their investigations of the earth and the universe.

As a follow-up to Ronnie Hastings' discussion of the Paluxy "mantracks" (September 1988), John Armstrong adds further experiences with this sad episode in which overzealous, but probably well-meaning, people became involved in distorting the truth in order to defend "truth" as they had concluded it to be.

Raymond Seeger's biographical series on scientists and their religious faith continues with a sketch of the life of Benjamin Franklin, one of America's "founding fathers." *SEARCH*, ASA's insert for laypersons, starts its second year of publication with a look at Ann Hunt, ASA Fellow and industrial chemist.

WLB

Bringing Blessings Out of Adversity: God's Activity in the World of Nature

STANLEY RICE

Department of Biology
The King's College
Briarcliff Manor, NY

In this article, I propose that God's creative activity in the natural world follows the same pattern as His interaction with humankind. He allows adversity to occur, then brings blessings out of it, as dual aspects of His will. First, we remember the pervasive biblical theme that God brings blessings out of adversity, both in biblical history and in our spiritual growth. I then document that God has also brought blessings out of adversity throughout the history of life on earth, and continues to do so in biological processes today. I believe that this view shows that the Creator and Sustainer of nature has acted in the same manner as the Lord of human history.

The existence of pain and suffering in the human world has hindered many observers from believing in the Christian God of Love. God permits humans to inflict evils upon one another because of free will; but why does He permit, or cause, disease, privation, and disaster? Skeptical observers of Christianity are further disturbed when they see that, throughout the history of the earth, animals have also experienced disease, strife, and privation.

Evolution is a process that favors the most efficiently selfish organisms at the expense of other organisms. If we say that God has allowed the evolutionary process to play a prominent role in earth history, if He used it as one of His mechanisms of creation, we encounter a contradiction: God condemns selfishness in humans, but rewards it in plants and animals.[1,2]

We cannot dismiss this difficulty by saying that what happens to plants and animals does not matter, that their suffering is without spiritual significance. Jesus called attention to God feeding the birds as evidence of His faithfulness. What about the birds that God does *not* feed, and they die? Is this evidence against his

lovingkindness? Christians are frequently forced into a position of weak apology on this point.

Jesus' miracles were blessings rather than the infliction of sufferings; He expects us to bless, not scourge, our neighbors. He will eventually eliminate suffering, whether traceable to sin or not, from the creation. God wants us to identify His activity with blessing, not with the sending of adversity. However, we cannot simply attribute adversity to Satan. Because God permits Satan to act, adversity is God's activity as well. This is demonstrated by the parallel accounts in II Samuel 24:1 and I Chronicles 21:1, in which adversity is identified as being God's activity and Satan's activity at one and the same time.

The Bible illustrates how adversity and blessing work together to accomplish God's will in the human world. God allows adverse circumstances to befall His people. Often He accomplishes this by the operation of natural law. People receive God's approval when they respond to adversity with positive creative activity based upon faith in Him. And it is this response that God desires. Frequently, God miraculously intervenes to rescue people from their adversity. God's creative mechanism, in human history and in the spiritual growth of each person, both with and without miraculous intervention, has been to bring blessings out of adversity. This point has been frequently made by Christian writers, and because of its importance it will be reviewed in this article.

However, the main purpose of this article is to demonstrate that God's creative mechanism in the natural world has been the same as His creative mechanism in human experience: to bring blessings out of adversity. Adversity in the natural world, such as privation, disease, and injury, results when God operates through the laws of nature. As a general rule, individual organisms and whole species respond creatively to and triumph over their circumstances.

A related theme is that in which prominence arises out of humility. It is related because it is frequently the humble people and the small individuals or rare species that experience adversity. Furthermore, this frequently entails the humiliation of the mighty, the bringing low of the lofty. These are the two sides of the same irony, in both the natural world and in human experience. In both we see the God who sends the rich away hungry but fills the poor with good things (Luke 1:51–53).

A Pervasive Biblical Theme

A. Biblical History

God has consistently brought blessings out of adversity in the biblical history of man. It not merely occurs, or occurs often, but is found in practically all of the major events of biblical history. I cite the following examples of important and sometimes extreme illustrations of this theme.

1. The theme is found in the first place in which it can be found: the creation of man. As Houston says, the Bible "out-Darwins Darwin."[3] No, we did not arise from the apes; our primordial origin is even humbler. The lords of Creation were fashioned from the dust of the ground. Ancient mythologies depicted the ruling class as descendants of the gods, and the slaves as mere dust. In contrast, the Bible declares that blessings are exalted out of lowliness: lowliness, in that even kings are made from dust, and exaltation, in that even slaves are no longer merely dust.

2. Adversity and privation, as we generally understand them, were absent from the Garden, but there was never a time in which mankind had no struggle whatsoever. God let the serpent into the Garden. Adam was called upon to struggle with, what was for him, a difficult decision. After the Fall, adversity came in the form of agricultural toil and painful childbirth. But even in the midst of pronouncing the Curse, and subjecting man to adversity, God planted a seed of blessing: Adam would bruise the head of the serpent (Genesis 3:15).

Stanley Rice teaches biology at The King's College in Briarcliff Manor, NY. He completed his Ph.D. in plant ecology at the University of Illinois at Urbana in 1987. He studied plant responses to variability of light conditions. His undergraduate degree, in environmental biology, was from the University of California at Santa Barbara. He has been an NSF Graduate Fellow and was elected to Phi Beta Kappa. He currently serves as secretary of the New York Metropolitan Section of the ASA. He continues joint research in plant ecology with a faculty member of Harvard University.

3. Cain was evil, but God counseled even Cain that blessing can arise from the struggle against adversity: "... sin crouches at the door; its desire is for you, but you must master it" (Genesis 4:8).

4. The humble Noah was chosen by God to repopulate the earth, even though other people probably had more wealth, strength, and cleverness.

5. Abraham was a landless sojourner, yet became the father of a chosen people as numerous as the stars.

6. Joseph was the least son, was sold into slavery, but rose to prominence both in Egypt and in his family.

7. The Israelites were chosen by God to receive His blessings even though they were least among the nations (Deuteronomy 7:7–8). Moses, cowardly at first (Exodus 2:14–15), is remembered as a great leader.

The Bible declares that blessings are exalted out of lowliness: lowliness, in that even kings are made from dust, and exaltation, in that even slaves are no longer merely dust.

8. The Israelites triumphed over enemies much stronger than they. In the case of Gideon (another least son who began as a coward), God deliberately contrived an ironic situation in which a small army gained victory (Judges 7).

9. King David was a lowly shepherd, the youngest son, whom Jesse forgot to bring to the meeting with Samuel. Even after he was anointed king of Israel, he fled to join the Philistines (I Samuel 27–28). From this sorry material God formed a man after His own heart, both in strength and spirituality.

10. The wise King Solomon was born in folly, from a wedlock which was the most shameful chapter of his father's life.

11. God consistently elevated obscure men to be His prophets (e.g., Amos 7:14).

12. The New Testament church was formed from humble men shunned by the religious establishment (I Corinthians 1:26–29, 4:8–13; II Corinthians 11:23–12:10). It hid in catacombs. All that Josephus could say was that the church was not yet extinct. But Christians number in the hundreds of millions today.

In each of the above cases, not only did the blessing come because God sent it, but a *creative response* on the part of the main characters was necessary. Certainly it was not the adversity itself that produced the triumph. Noah applied his resources, talents, and energy to boat-building, and Gideon bravely hacked down the grove. An unclaimed blessing is wasted, as in the case when Cain did not struggle to overcome sin.

The creative response must be undertaken in an optimistic spirit, a belief in the goodness of the God who is in ultimate control of all things. This is one way in which biblical accounts of blessing arising from adversity differ from the hero mythology of pagan cultures. Could there be any clearer example of triumph over adversity than that of Odysseus? Yet he had only a shadowy half-existence to look forward to in the realm of Hades. The Germanic heroes overcame monsters and rejection by men, yet nothing could forestall the eventual Götterdämmerung. How different is Jacob's wrestling all night with God. He received the name of Israel not merely because he struggled, or because he struggled with God, but because he did so with the absolute conviction that in the end God would bless him (Genesis 32:26).

This theme also permeates secular history. The humble, downtrodden people overcome the lazy rulers time and again. And frequently the peoples that have faced the greatest resource restrictions have striven the most to rise above their limitations. Rene Dubos' favorite example of creative response to adversity was the Netherlands, which gained worldwide power despite an almost total lack of natural resources.[4] The inner human desire to respond creatively to adversity is assuredly a better paradigm for the interpretation of secular history than is either the "great-man" theory or Marxist economic theory. Biblical history illustrates this theme better than secular history because of God's direct involvement in the history of Israel and of the Church.

B. Spiritual Development

God places a higher value upon recovery from suffering than upon a life of ease and luxury. The Lord is a shepherd who leads us through the valley of the shadow of death and into the presence of enemies. The "bones that you have broken will rejoice" (Psalms 51:8). Iron sharpens iron (Proverbs 27:17), wounds lead to cleansing (Proverbs 20:30), and the Lord purifies hearts in the same way that the fiery crucible purifies precious metals (Proverbs 7:3, Isaiah 48:10). He does not prevent us from being weary; instead He renews the strength of the weary (Isaiah 40:29–31). He does not prevent us

from being born into poor circumstances, but He exalts the poor (Isaiah 40:4). Our hardships play an essential role in our spiritual maturation (Romans 5:3–5; II Corinthians 4:7–12, 12:9). "A life without obstacles to overcome would be almost as bad as a life with only obstacles that could not be overcome."[5]

C. Jesus Christ

The life of Jesus Christ seems to express the theme of blessing arising out of adversity in every possible way. He was prophesied to suffer physically and carry the burden of sin for all of us (Isaiah 53:4–6). A Davidic lineage did not shield Him from being born of humble parents, in a shed, during a time of political oppression. He grew up in Nazareth ("Can anything good come from Nazareth?" John 1:46). He submitted to the humility of baptism, to temptation while starving in the wilderness, to continual harassment by religious authorities, to privations, and finally to torture and death. The cross was an instrument of torture and a symbol of shame. Yet He was raised from the grave and now rules the universe. Despite the fact that He is all-powerful, He does not boast in it; instead He calls Himself "The Lamb." His worthiness for praise emerges not so much from His present power as from His sacrifice of Himself (Philippians 2:5–11, Revelation 5:9). The stone rejected by the builders became the cornerstone (I Peter 2:7). The Resurrection was the supreme instance of an ironic victory of blessing over hopelessness and death.

A Pervasive Natural Theme

The above references strongly suggest that the passage from adversity to blessing is a positively good thing in itself, something God intended from the outset in the situations referred to, rather than a patch-up of something that went awry. And if this theme pervades the Bible, if it is arguably the major mechanism of God's activity within human experience, then we would expect God to act in the natural world, as its Creator, in the same manner (II Corinthians 5:17). We should find, in the history and present operation of life on earth, a drawing forth of blessings out of adverse situations. And, as in biblical history, this may sometimes involve miraculous intervention.

The Bible itself instructs us to look for this pattern within the natural world. Samson's riddle (Judges 14:14) said that sweetness comes forth from the lion, king of beasts, only after it is humbled in death. Ezekiel 17:24 explicitly identifies the elevation of the humble as a theme symbolized within the natural world.

This view of the natural world inclines us to reject two of the more common beliefs about the mechanism of God's creative activity. We would, first, reject that version of creationism that claims that God created the universe as quickly and efficiently as possible.[6] We would also reject that version of theistic evolution that interprets natural law, in itself, as carrying out God's complete will. God neither creates us instantly into spiritual maturity nor does He leave our spiritual growth to the mercy of circumstances. In like manner, His creation activity in the natural world is neither maximally efficient nor need it occur solely by means of the vicissitudes of evolution.

Obviously, we face a problem with interpreting natural history in terms of blessing arising from adverse circumstances. "Blessing" suggests progress—greater complexity or diversification of organisms. But what do we mean by considering such things to be blessings? We are forced into subjective judgment, thrown into the realm of metaphor. This is why I have advocated a metaphorical approach to the Christian interpretation of the natural world.[7]

[God's] creation activity in the natural world is neither maximally efficient nor need it occur solely by means of the vicissitudes of evolution.

I believe, however, that there is no problem with imputing the concepts of blessing and adversity upon the nonhuman world. Natural disasters, for instance, seem bad to humans, while the persistence, diversification, and proliferation of life all seem good. I suggest that God operated in the history of the natural world in such a way as to bring blessing out of adversity, as these concepts would later be understood by humans. He had the General Revelation to *us* in mind as He superintended the history of the cosmos.

If the theme is truly pervasive in the natural world, then it should be illustrated in both evolutionary and non-evolutionary areas of biology, in both the history and in the current operation of life processes. We must be suspicious of making an exception in our treatment of the natural world in order to accommodate evolution. Therefore, I will document the theme of blessing arising from adversity as it appears in the history of life on earth, and in the current operation of life of earth (physiology and ecology). Because many of the examples below are found in introductory biology texts and other readily accessible sources, I will only outline them here. As will become evident, the theme is reconcilable

with either a progressive-creationist (although not a young-earth creationist) or a theistic evolutionist approach, and I have used terminology that is consistent with either.

A. The History of the Earth

1. The origin of life. Life itself is humble, no match for the raging elements. It is ironic that the first delicate bit of protoplasm on earth survived at all.[8] Furthermore, some biochemists suggest that cyanogen (composed of two cyanide residues) was important in allowing the synthesis of complex molecules from simple molecules.[9] If this is so, then life itself was created by means of a molecule that today is known for its poisonous properties.

2. The primordial poison. The first lifeforms, say most biologists, derived energy from the organic soup in which they lived. But a crisis arose when their populations outgrew the food supply. At just this moment, photosynthesis (the transformation of sunlight into food energy) originated and provided a food source.

However, the by-product of the major form of photosynthesis is oxygen gas. This gas can readily remove electrons from water, forming peroxides, superoxides, and oxygen radicals.[10] Therefore, oxygen is poisonous to anaerobic life forms, which do not possess enzymes to destroy the peroxides, superoxides, and oxygen radicals. Most modern life forms are aerobes, which do possess these enzymes and can thereby protect themselves from oxygen toxicity. Life has overcome the toxicity of oxygen, but it has done even better than this. Aerobic organisms do not merely protect themselves from oxygen but put oxygen to use. Their respiratory enzymes allow eighteen times as much energy to be released from foods in the presence of oxygen as in its absence. The efficient use of food energy was made possible by poisonous oxygen gas. And it is the ability to take up low-energy electrons, the very property of oxygen that is most dangerous, that makes aerobic respiration possible.

3. The importance of anaerobes. Practically every organism we see around us is aerobic. However, it is incorrect to assume that anaerobes play no significant role in the world. It is the anaerobic methanogens that release methane into the atmosphere, playing a vital role in the ecosystem by regulating atmospheric oxygen levels.[11] And there are other, partially anaerobic bacteria that can transform atmospheric nitrogen gas—which is useless to most organisms—into nitrates. This process is the major pathway by which nitrogen atoms become available to all the plants and animals on the earth. The anaerobic bacteria have been driven into obscurity, but they make the continuation of life on earth possible.

4. The first symbioses. Symbiosis is the close association between two species to an extent that one requires the other for survival. The symbiosis called "parasitism" benefits only one of the species, while the symbiosis called "mutualism" benefits both. Most biologists believe that mitochondria (the organelles inside cells that carry out aerobic respiration) and chloroplasts (the organelles inside plant cells that carry out photosynthesis) were formerly free-living bacteria which parasitically invaded larger cells.[12] The host cells, however, found a way to make the invaders useful, transforming the adversity of a parasitic relationship into the blessing of a mutualistic one.

Biological blessings both of structural complexity and of species diversity arose in response to the adversity of life on dry land.

5. The invasion of the land. Dry land is hazardous to biological processes, which must take place under water. The movement of life out of the water onto the land required the development of structures and functions to obtain and conserve water, regulate temperature, provide skeletal support, and transport sperm. Simple life forms can live only in water. Most species of plants and animals live on dry land. Thus, the biological blessings both of structural complexity and of species diversity arose in response to the adversity of life on dry land.

6. Mammals. For the first time in 100 million years of their existence, mammals faced the adversity of being under the shadow of the dinosaurs. Today, the dinosaurs are gone and mammals have taken over many of their former roles in the economy of nature. Here is a reversal in which the humble were elevated and the proud were brought low—quite dramatically, say many scientists, by means of a worldwide disaster, perhaps an asteroid.[13]

7. Placental mammals. When the Panama land bridge allowed placental mammals from North America to enter South America, the placental mammals are believed to have driven many marsupial mammals to extinction.[14] In recent history, placental mammals introduced into Australia have driven many marsupials into extinction there. These conquests were not due to

any inherent superiority of the placental reproductive system, but rather because placental mammals had experienced the northern conditions of environmental adversity and were stronger as a result.[15]

8. Arthropods. Insects and spiders are small and tend to go unnoticed when evolutionists use such terms as "The Age of Reptiles." Yet the humility of small size has allowed arthropods, in their own way, to rule the world. They utilize many niches unavailable to larger creatures, and are dominant both in number of species and of individuals on earth.

9. Life is fighting back. Despite our praise of life's resilience to adversity, we know that most species that have lived are now extinct. However, Raup and Sepkoski have found that the rate of extinction has declined during the hundreds of millions of years of life on earth.[16] It is ironic that life can fight back with a progressive degree of success against the disasters and reversals imposed on it.

10. Harsh environments. There is virtually no place on earth, however harsh its conditions, that is devoid of life. The blessing of life has flourished even in the driest and saltiest deserts. Life, like its Creator, is everywhere (Psalms 139:7–12).

11. The value of small populations. Small, isolated populations within a species, with the double disadvantage of small size and peripheral status, are believed to have contributed greatly to the evolution of the whole species in many instances.[17]

12. Altruism. Among animals, acts of altruism (self-sacrifice for the apparent benefit of another individual) are observed. The origin and persistence of these superficially unselfish behavior patterns have generally been explained by the selfish terms of natural selection.[18] To many observers this means that altruism is "merely" selfishness in disguise; that life forms, after all, labor under the adversity of enslavement to selfishness. We can turn the statement around, however, and note that, among animals, the blessings of altruism have in fact arisen despite the selfishness of natural selection.

13. Mutualism from parasitism. The example mentioned in #4 above of mutualistic mitochondria and chloroplasts arising from parasitic ancestors is apparently not an isolated instance. Parasitic diseases in which the parasite and host have influenced one another's evolution for a long time tend to be less deadly to the host than incipient disease associations.[19] Even the partners in the most advanced mutualistic associations, such as the algae and fungi that form the bodies of lichens, can behave parasitically toward one another under some circumstances, suggesting that the mutualistic association had a parasitic origin.[20] Symbiotic relationships in general appear to develop from parasitism toward mutualism.

If the panda's thumb is indeed an improvisation, it merely reveals our Creator as one who values the ironic cleverness of making serviceable systems out of humble leftover parts.

14. Improvisation. Gould was criticized by anti-evolutionists when he said that the panda's thumb (not really a thumb) was an improvised contraption, "jury-rigged" from leftover parts, and was not worthy of a Creator who made everything perfect.[21,22] He and his critics agreed that the thumb, although inelegant from a human engineer's viewpoint, served the panda's purposes adequately. If the panda's thumb is indeed an improvisation, it merely reveals our Creator as one who values the ironic cleverness of making serviceable systems out of humble leftover parts.

B. Non-historical Biological Processes

1. Acclimation. Just as species can make evolutionary responses to environmental challenges, individual organisms are not passive when confronted with environmental adversity. Instead, they make chemical and structural adjustments to the adverse situations. Shade, drought, strong wind, and grazing are clearly detrimental to plants, but when exposed to these conditions the plants develop striking structural adjustments which enable the plants to withstand such adversity more readily in the future.[23] Animals adjust body heat production and blood salt levels in response to environmental fluctuations. Creative responses, rather than passive submission, to adversity, which strengthens as a result of exposure to challenges, is perhaps the primary pervasive theme of physiology.

2. Succession. Places which have experienced the adversity of flood, fire, landslide, or human activity do not long remain barren. Plants reclaim the barrenness by the process of succession. For example, sand dunes deposited by the waves of Lake Michigan are very inhospitable to plant life. But a few plants survive there, and their roots stabilize the sand, and soil begins to form as dead foliage decays to humus. Eventually, an

oak forest grows on what was once a dune. The blessings of high moisture and rich nutrient conditions replace the dry sterility of sand. The most basic characteristics of succession, a nearly universal ecological phenomenon, is environmental amelioration: relatively harsh conditions are moderated into relatively good conditions. The growth of trees in formerly barren regions is something for which God requests our thanksgiving (Isaiah 41:18–20).

Instead of adversity and blessing representing contradictory aspects of God's activity, the adversity should not be viewed apart from the blessing to which it gives birth.

Small disturbances such as treefalls and lightning bolts continue to occur in the forest even after succession appears completed. Succession never reaches an endpoint of heavenly stasis. The adversity of small disturbances serves an important function. If they did not occur, the forest might become clogged with dead wood and crowded with pale saplings. Small disturbances make the environment healthier than it would be in the absence of disturbance, because they allow forest trees to regenerate[24], and allow a forest to have both optimum species diversity[25] and maximum efficiency of nutrient conservation.[26]

Conclusion

The sixteen examples presented above are some of the major events of life's history and major characteristics of its current operation. The theme of "blessings arising out of adversity" pervades life, as it pervades the history of God's interaction with mankind. Instead of adversity and blessing representing contradictory aspects of God's activity, the adversity should not be viewed apart from the blessing to which it gives birth. As Hugh Macmillan wrote in 1874:

> . . . the All-Wise brings order out of confusion, and life out of death . . . the summer beauty of our hills, and the autumn fertility of our valleys, have been caused by the cold embrace of the glacier; and so by the chill of trial and sorrow are the outlines of the Christian character moulded and beautified. And we who recognize the loving-kindness as well as the power of God in what may seem the harsher and more forbidding agencies of nature, ought not to weary or faint in our minds, if over our own warm human life the same kind . . . hand should sometimes cause His snow of disappointment to fall . . . knowing that by these unlikely means shall ultimately be given to us too, as to nature, the beauty of Sharon and the excellency of Carmel.[27]

The Lord of history has acted in the same manner as the Creator and Sustainer of nature. There is, therefore, a thematic unity of nature and history when viewed from a Christian perspective. I believe this contributes greatly to the credibility of Christianity.

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[7]Rice, *op. cit.*

[8]Birch and Cobb, *op. cit.* "With electrical storms raging above and volcanic eruptions below, who would have predicted that a tiny delicate jelly-like blob . . . could have endured . . . " (p. 108).

[9]Dickerson, R.E., 1978. "Chemical Evolution and the Origin of Life," in: *Evolution, a Scientific American Book*. San Francisco: W.H. Freeman, pp. 30–47.

[10]Hydrogen peroxide, and an iodide peroxidase, are essential for the oxidation of iodide in the thyroid; oxygen radicals and hydrogen peroxide are important in the killing of microbes by leukocytes. These examples also show that " . . . agents of adversity have been put to constructive use." Fridovich, I., 1976. "Oxygen Radicals, Hydrogen Peroxide, and Oxygen Toxicity," in: Pryor, W.A., ed., *Free Radicals in Biology*. New York: Academic Press, pp. 239–254.

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[15]Gould, *op. cit.*

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Happy the man whom God rebukes!
therefore do not reject the discipline of the Almighty.
For, though he wounds, he will bind up;
the hands that smite will heal.
You may meet disaster six times, and he will save you;
seven times, and no harm shall touch you.
In time of famine he will save you from death,
in battle from the sword.
You will be shielded from the lash of slander,
and when violence comes you need not fear.
You will laugh at violence and starvation
and have no need to fear wild beasts;
for you have a covenant with the stones to spare your fields,
and the weeds have been constrained to leave you at peace.
You will know that all is well with your household,
you will look round your home and find nothing amiss;
you will know, too, that your descendants will be many
and your offspring like grass, thick upon the earth.
You will come in sturdy old age to the grave
as sheaves come in due season to the threshing floor.

Job 5:17–26

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Crises of Conscience for Christians in Science

RICHARD H. BUBE

Department of Materials Science & Engineering
Stanford University
Stanford, California 94305

Dealing with crises of conscience for Christians in science requires a prophetic approach. Although there are serious crises arising from areas related to the theme of this conference on "Science, Weapons, and Hope: Christian Perspectives," the subject itself has far greater significance and implications. The possibility for crises of conscience implies an authentic responsibility borne by Christians in science based upon a fundamental stewardship that is ours as Christians. Crises arise out of the tension between the realization that in a sinful world any increase in knowledge is potentially dangerous, and the realization that if science did not exist, Christians would have to invent it to fulfill their obligations in the world. Crises of conscience appear when Christians in science see directly the probable harm that will result from their work. We pose the guideline question: "If a scientist would not approve the use *of a process or device* if *developed, shouldn't he refuse to work on its development?" We consider examples of crises of conscience in several different areas of science, with particular attention to weapons research and development as a response to evil in the world. A constant pitfall is "religious pragmatism," which is based on a religious context and admits the direction of the biblical teaching on a particular issue, but concludes that this direction is not practical in the sinful world in which we live.*

Introduction

The opportunity to address the subject, "Crises of Conscience for Christians in Science," as the opening address of a conference dedicated to the subject of "Science, Weapons, and Hope: Christian Perspectives," is a challenging one indeed. It is challenging because it is particularly in these crises of conscience that the Christian position is most dramatically put to the test. It is in these crises of conscience that we are most strongly challenged to find out whether our proposals for the integration of input from authentic science and authentic Christian theology are really acceptable and supportable.

At the same time, such a discussion of crises of conscience is challenging simply because "crises" are the subject. To admit that crises exist is to admit that Christians have a hard time deciding the appropriate courses of action. To admit that Christians have a hard time deciding is to admit further that in any gathering such as this there will be a wide range of Christian convictions, some of them held with devout dedication. The temptation to lay out final resolutions for all crises, in a take-it-or-leave-it way, is likely to produce only a

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polarization among Christians. I trust that we will all be very conscious of the unity of all those who truly commit themselves to Jesus Christ in the Holy Spirit, and will be able to come from this conference with a renewed dedication to Christ, one another, and the living out of His Way. It is through conferences such as this that the Holy Spirit is pleased to guide His people.

And yet there is a need to speak almost prophetically, being as honest and forthright as possible. Crises of conscience arise very often in connection with "Science, Weapons, and Hope," but they are by no means limited to this area for Christians in science. I would like to share with you, therefore, a general view of crises of conscience, and then to give some examples from particular areas, among which one of the most common is the subject of this conference.[1]

Finally, I would leave you with two major thoughts: For Christians in science to have crises of conscience is a sign of Christian maturity. For Christians in science to act decisively on the basis of such crises of conscience, not succumbing to what I will call "religious pragmatism," is a sign of Christ's power in their lives.

The Issue of Responsibility

To speak of a crisis of conscience *as* a Christian in science implies that Christians in science have a particular responsibility both because they are Christians and because they are in science. It is this kind of dual or overlapping sense of responsibility that underlies many of the discussions of the members of the American Scientific Affiliation. If we were *only* Christians, we would perhaps not have the knowledge or the involvement in science to make meaningful decisions. And, of course, if we were *only* scientists, we would not have the biblical guidelines that characterize lives lived in response to the call of Christ. It is because we are both Christians *and* scientists that we cannot avoid attempts to clarify the nature and the extent of our responsibility.

Being a Christian in science is a difficult task, perhaps especially today. For a time, we could relax in the assurance of a scientific mythology—of which I say more later—that it is enough for Christians in science simply to investigate the marvels of the natural world, thinking God's thoughts after Him, with scarcely a thought for the results of their investigations. In this somewhat naive approach, Christians in science could trust that somehow knowledge produced goodness, and that the results of their work would be put primarily to a humanitarian and productive use.

Reflection, however, indicates to us immediately that every advance with the potentiality for good has a potentiality for evil that is probably proportional to the good. It is also clear that while people of good will are attempting to develop the potentiality for good, others are as busily engaged in developing the potentiality for evil. Every increase in knowledge is inherently dangerous. The only way to be sure of not contributing to the use of new knowledge for evil is to avoid all efforts to obtain new knowledge in the first place.

Although there are certainly areas of human investigation where a simple cessation of activity is the informed response of Christians in science, it is clear that the general responsibility of Christians and the Christian community to meet the needs of the people in the world cannot be met by advocating a simple end to all science. If, in fact, science did not exist, Christians would have to invent it in order to be faithful to their call to be stewards of the earth for God and their fellow human beings. Excellent cases have been made for the historical premise that one of the main contributors to modern science was the Judaeo-Christian world view.[2,3] Here is a tension that cannot be resolved by some simple choice of one extreme or the other, but must be recognized and lived out constantly by a walk in faith down a middle path.

Once we recognize that the responsibility of Christians in science rests upon their unique role as stewards of God's creation, we must conclude that this responsibility imposes certain concerns and actions upon Chris-

Richard H. Bube received the Ph.D. degree in Physics from Princeton University. From 1948-1962 he was on the technical staff of the RCA Laboratories in Princeton, New Jersey, and since 1962 he has been on the faculty of Stanford University as Professor of Materials Science and Electrical Engineering. From 1975-1986 he served as Chairman of the Department of Materials Science and Engineering. Dr. Bube is the author of books both on photoelectronic materials and devices, and on the interaction between science and Christian faith. From 1969-1983 he served as Editor of the Journal of the American Scientific Affiliation. He has been a speaker on science and Christianity on many college and university campuses.

tians. Scientists, the producers of the potentiality for good or evil, cannot sit back and let non-scientists make all the decisions about the uses of it. Scientists resist becoming politicians and activists, but for some there may be no other choice. Some may indeed be driven even to giving up science at some place and at some time, if their own circumstances totally prevent an honest expression of conscience and commitment to Christ.

The responsibility of Christians in science must be construed in terms of their respond-ability. Since scientists are the *producers* of the potentiality for good or evil, their responsibility does not begin only when the potentiality has been brought into existence, but it begins back when the potentiality is still only an unrealized speculation.

Scientists must feel immediate responsibility for the direction and goals of their work. They cannot abdicate and place this responsibility on the shoulders of others in authority over them, such as their supervisors, their company board of directors, or their government. Any time that scientists devote their talents in a direction that violates their basic moral conscience, they have given up their choice position as responsible professionals in society and have become technical prostitutes instead. In the final crisis, for the Christian it must always be a choice of God's law over human law, and the claim that it is moral, or required, or even allowed, because it is legal according to human law is a deceptive claim indeed.

Facing Crises

Crises of conscience arise when scientists directly see the *probable harm* that will result from success in their research and development work. Should they refuse to work on the project? Should they continue to work, but plan actively to influence the use of the results?

Every advance with the potentiality for good has a potentiality for evil that is probably proportional to the good.

I suggest the following question as a way of summarizing these ideas: "If a scientist would not approve the *use* of a process or device *if* it were developed, shouldn't he refuse to work on its development?"

Crisis for the Ideals and Identity of Science

In any discussion of crises of conscience for Christians in science, we must step back far enough to recognize that there is a fundamental crisis in both the ideals and the identity of science today. Since this basic crisis has so many implications for specific problem areas, we need to consider it first of all.

In the final crisis, for the Christian it must always be a choice of God's law over human law.

In the past few decades, science has changed from being a quasi-neutral pursuit of understanding of the universe to the situation where today's scientists and engineers—the largest number ever living at one time since the beginning of the world—are controlled either by the economic concerns of big business or the military concerns of big government. This situation has profound effects on both what science is and what scientists do. Christians must consider whether the actual opportunities available in a scientific career merit—or perhaps even allow—their participation. In view of the ambiguity of science and its ability to provide the means for evil as well as good in the world, it is inevitable that Christians should repeatedly ask "Is this a worthy life's activity for me?" Young Christians particularly need to be aware of these issues as they consider what vocation is most consistent with their Christian commitments.

I cite just two examples from my own recent experience at Stanford University. All the members of the graduating class this year were invited to consider making a voluntary pledge that when they considered their future employment, they would take account of the ecological impact of that employment.

My other example is the comment of a Christian graduate student in my department, whom I invited to list several of his personal "crises of conscience."[3] His first entry was as follows: "As a graduate student investing large amounts of time and money to specialize in high technology, I feel that time and money are being diverted from the solution of major human problems, such as hunger and inadequate housing and sanitation. In addition, the discoveries I make and the work I do may actually make the above problems worse rather than better."

At least over the first fifty years of this century, a

definite concept of what it meant to "do science" developed and was taught in our schools, colleges, and universities. It is still probably the dominant meaning being taught today, on the basis of which men and women are making career choices. People are led to believe that there are many opportunities to make a career out of increasing our understanding of the natural world. They are led to believe that such a career is accepted as being beneficial to society, both for the general contribution to human understanding and also to providing a fund of knowledge upon which those involved in more applied pursuits can draw. The implication is that the support of such scientific research is a priority of the collective society, expressed through government grants and contracts, and also of the various technologically oriented industries, which recognize the importance of building a basis of understanding for future developments.

This view of science may well be much too self-serving and idealistic to represent the actual state of affairs in the real world over any appreciable length of time. It may, in fact, simply be a kind of "scientific mythology," which may continue to be perpetuated by word of mouth even though actual societal practice denies it.

Today's scientists and engineers . . . are controlled either by the economic concerns of big business or the military concerns of big government.

But two major developments of the past few decades, the industrialization and the militarization of science, have so changed the general perspectives of a scientific career, that crises of conscience among those involved in such careers are not uncommon. We find that much of scientific research today is motivated by one of two simple questions: (1) does the research promise financial profit in the near future (the industrialization of science) or (2) does the research promise contributions to the military program (the militarization of science)?

After the second World War, many of the major industries in the United States entered into a program of setting up and encouraging major research laboratories with the goal of developing applied science. A student graduating with an advanced degree in science in the late 1940's and 1950's could consider employment by a variety of industrial laboratories such as Bell Labs, General Electric, RCA, Sylvania, GTE, US Steel, Eastman Kodak, Rockwell, Xerox, Texas Instruments, and many more, all which had basic and applied research groups of a major size. University research laboratories were dedicated to the pursuit of basic science as a contribution to society and as an educational medium for students.

Where are those industrial science laboratories today? In thirty years drastic changes have taken place in every one of the major industrial laboratories, so that today fundamental and applied science occupies only the smallest part—if any—of the laboratories' programs.

Today we are seeing a parallel process taking place in our major research universities. With growing needs because of the increased tempo of commercial competition, not only do American industries not have the time and resources to develop new understanding, they do not have the time and resources to handle their own manufacturing problems. As a consequence, they are turning more and more to the universities as a resource that can be put into the service of solving manufacturing dilemmas. However beneficial such relationships between industry and university may be in particular cases, the net effort of a major industrialization of our universities will drastically change the meaning of "doing science."

Coupled with an industrialization of science is a militarization of science. The expectation that the doing of science leads to positive contributions for society as a whole is seriously called into question with the increasing support of scientific and engineering research for purely military purposes. For many years, a large fraction of scientific research has been supported under the aegis of a contribution to the national defense. This means that the choice of research topics and the direction of research efforts tends to be more or less directly influenced by military needs in a proportion out of balance with overall human needs. This emphasis increases in impact with every succeeding year.

There are many other characteristics of the way that science is developing in our day that call into question the ideals and the identity which people have commonly ascribed to science and a career in science.

The realization of the loss of the "myth" of science leads to disillusionment and frustration for people who entered the field with certain expectations and now cannot find them.

The influence of utilitarianism, material success, and

practical goals in scientific work lead people to wonder whether it is sufficient for them to be involved only in helping business success and increased profits, regardless of the intrinsic value or necessity of the products.

We find that much of scientific research today is motivated by one of two simple questions (1) does the research promise financial profit in the near future or (2) does the research promise contributions to the military program?

The growing importance of big machines and big costs as essential for doing meaningful science has drastically changed its character. Louis W. Alvarez, Nobel prize winner in physics in 1968, confesses in his autobiography that if he were starting life over, he would no longer be able to become a particle physicist.[4]

More and more scientific research and development involves toxic chemicals, poisonous gases, and possibly dangerous new life forms, all of which threaten the environment even when involved only in experimental work, but especially if the experiments are put into practice with widescale production.

Certainly it is right and proper for Christians so gifted by God to take part in the pursuit of scientific understanding and in the application of science to meet authentic human desires and needs. But it is also essential for Christians to be aware of the changing character of a career in science and engineering, and to take seriously the relationship of the real situation with the commitment they have made to live as disciples of Jesus Christ. It is out of this interaction that crises of conscience arise.

In order to be more specific, I would like to consider four areas only as *examples* of the intricacy of the crises of conscience experienced by Christians in science.

Beginning of Life

Christians working on scientific techniques and processes involved in various procedures to bring about or sustain new beginnings of life are involved in crises of conscience. To what extent are we justified in using new methods to allow pregnancies to occur under conditions in which they would not do so "naturally"?

Even the fairly simple procedure of *in vitro* fertilization using the husband's sperm and the wife's ovum moves the beginning of life from the home to the laboratory. This procedure can readily be expanded to include donor's sperm and donor's ovum. Is it fundamentally a Christian response to a legitimate desire to have children, or is it a step toward ultimate dehumanization? Kass points out that our view of life and the world is reflected in the terms used to describe the generation of life: for the Hebrews, "begetting" or "siring"; for the Greeks, "genesis"; for the pre-modern English-speaking Christian, "procreation"; for the modern, entranced with mechanization, "reproduction"; in Aldous Huxley's *Brave New World*, it becomes "decantation."[5]

If, in the process of *in vitro* fertilization, only some of the fertilized eggs are actually implanted, how do scientists respond to the remainder? Can they do experiments with them to help treat organic diseases in order to live out their commitment to help human beings in need? And what would be the larger societal effects of such decisions?

Can a Christian work at a sperm bank or an ovum bank? Can a Christian work at a support facility for surrogate mothers? Can a Christian do research on cloning human beings? Can a Christian engage in research directed toward genetic manipulation in order to find cures or treatments for the various diseases associated with genetic defects, knowing that success will certainly lead to many other applications?

Ending of Life

Can Christians devote themselves to the development of sophisticated techniques to maintain human biological life even beyond the apparent termination of self-conscious personal life? Can they justify the time and money spent in the development of ever more powerful technological approaches and machines in order to maintain human biological life, knowing that only the wealthy have access to them and that the money invested in maintaining for a brief time the biological life of a few could be spent to help and improve the personal life of many?

It appears to be within the scope of technological ability to maintain biologically alive the cadavers of individuals for years after personal death has occurred.[6] These could be considered banks, or farms, of cadavers requiring feeding and maintaining, awaiting the time of harvest. They could be used for training medical students, for testing of drugs and surgical procedures, various medical experiments, as organ and blood banks, and as manufacturing units for antibodies, all in a

cost-effective way. Can a Christian be involved in research and development of this type?

Are many of these examples actually situations where one might not ascribe some particular evil to a well-defined act, but where one might still argue against the widespread application of such acts because of their almost inevitable deleterious effect on social awareness? This idea is expressed well by Gaylin: "Sustaining life is an urgent argument for any measure, but not if that measure destroys those very qualities that make life worth sustaining."[6]

Ecological Concerns

Advanced technology drives us relentlessly to processes and approaches that threaten the environment around us. We all know of acid rain, toxic wastes, the carbon dioxide layer, and the hole in the ozone layer. This was certainly the motivating force for the pledge of ecological concern suggested for Stanford's graduates this year. We are living on a finite earth with finite resources and finite capabilities for being changed from its natural state. Can Christians continue to develop new technologies or exploit present ones without an ongoing concern for these issues? Can we continue to act as if tomorrow's technological solution was the preferred solution for every problem induced by yesterday's technology?

When we know that there is an approaching ultimate limit to energy production on earth before the temperature of the earth is radically increased, can we as Christians continue in scientific and engineering development without regard for alternative, renewable energy sources, conservation of energy, and altered lifestyles?

The choice of research topics and the direction of research efforts tend to be more or less directly influenced by military needs in a proportion out of balance with overall human needs.

Can Christians in science and engineering continue to develop processes involving more and more toxic materials, so that our environment and our communities are endangered by chemical wastes that do not decay with time? Can Christians devote all of their skills and abilities to increasing the high technology of affluent Western society, using up fossil fuels and scarce elements, while effectively ignoring the very simple human requirements of the Third World? How seriously should more Christians consider the possibility of "tent-making" ministries to other countries of the world traditionally closed to missionaries and other presentations of the Gospel?

One of the difficulties in assessing the responsible Christian answers to the above questions, is the fact that they are not questions to which the Bible writers address any simple and direct treatment. They involve problems, options, and situations that were totally foreign to the society of Jesus' day. Resolutions of these crises of conscience must therefore be based on conclusions derived from general biblical guidelines, often without common agreement among Christians as to how to proceed to actual practical directions for living today.

Weapons Research

The fourth and final area we consider for crises of conscience is the area of immediate concern to this conference. It is somewhat different from the previous three. The biblical situation did not contain any direct references to *in vitro* fertilization, genetic engineering, maintaining of cadaver banks, or development of techniques and processes with careful regard for environmental problems in an industrial age. But the biblical situation was fully cognizant of issues of war and peace, friend and enemy, and of the procedures involved between antagonistic human beings. To be sure, the biblical situation did not proceed beyond bows and arrows, swords, spears, or horses, but it would seem a curious inference to suppose that the increased ability of today's weapons to kill people, and the fact that many of them have no use whatsoever except to kill people, should in any way make their use more favored.

Because of the fact that the Bible does have much to say about issues directly relevant to the use of weapons, it is essential for us to take a look at them. We do that, of course, fully aware that they have been endlessly debated in the past, and will continue to be debated at this meeting. Even as a prophet, I will not presume to make a decision for any other Christian concerning his or her participation in research and development of military weapons, but I will try to state clearly the teaching of the Bible on the issues that must be used in order to arrive at a decision concerning involvement in such research and development.

Here we face a question that is perhaps the greatest, the most common, the most certainly to be encountered in a key role in the future of the human race: the fundamental question, "How should we respond to evil

in this world?" In some of the other considerations we have mentioned as crises of conscience for Christians in science, many others who are not Christians may also have agreed. But when it comes to the question, "How should we respond to evil in the world?" the Christian response is almost unique. If our response to this question as Christians is not different from the common response of those who are not Christians, then we are in danger of losing the very essence of Christianity itself.

Resolutions of these crises of conscience must be based on conclusions derived from general biblical guidelines, often without common agreement among Christians as to how to proceed to actual practical directions for living today.

Christians themselves are widely split on the answer to this question. Our attitude toward science and the applications of science depend crucially on its answer. It goes to the very heart of the Christian Gospel and to the meaning of that Gospel in the Christian life. It probes the authenticity of the Christian message and demands that we put even our lives on the line.

Why does it pose a crisis of conscience? It is simply this. On the one hand, we have the clear New Testament teaching that the role of the disciple of Christ is to be the role of love; embracing not only friend and family, but extending even to the enemy. The reason for this is fundamental: love is the *only* authentic and practical way to overcome evil in this world. Such love may require personal sacrifice, even the laying down of our lives. Jesus faced the evil of the world in exactly this way as our example: the only way in which He could break the power of evil, and lay open the road to forgiveness and restoration of fellowship with God, was to lay down His life out of love. If he had done anything other than that, God's plan of salvation would not have been achieved.

On the other hand, we have clear biblical teaching that the role of the disciple of Christ is to be the protector of the helpless, the defender of the oppressed: the one who in the presence of the evil of the world demonstrates the love of God by being willing to defend the defenseless against the evil of other people. Christians may be willing to sacrifice themselves rather than respond violently to the perpetration of evil, but do they have the right (the duty?) to sacrifice the lives of others as well, even those who do not share in the Christian commitment?

To find the *Christian* response to these questions, we ask only a single question: What is the significance of the teaching and life of Jesus Christ for these issues? It may seem at first that this approach is inadequate. We may prefer to ask other questions instead. Does this make sense? Will it work? Will it achieve the goals that we desire? Will it prevent suffering? Is it a practical approach? If we follow it, will we probably lose our desires, our freedom, and perhaps even our lives?

If we are to be faithful to our goal, however, we must ask none of these questions—at least, not in such a way that they dictate the answers that we give. We may insist that the teaching and life of Jesus Christ is not enough for us to consider; we must also consider the Old Testament, or we must reckon with a systematic analysis to synthesize a theology following some tradition. We may indeed obtain other helpful insights and guidelines from such procedures, but at the very least they must not contradict the teaching and life of Jesus. As Christians, we are called to follow in the steps of Christ here and now. If we conclude, even for a moment, that this life is not going to work, what are we saying about the authenticity of Jesus as the Christ, the Son of God? If we say that this life is foolish and incapable of being responsibly followed, what are we saying about the trustworthiness of the One whom we proclaim to accept as Lord and Savior?

We have the clear New Testament teaching that the role of the disciple of Christ is to be the role of love; embracing not only friend and family, but extending even to the enemy.

If we look carefully at the teaching of Jesus in the Synoptic Gospels and John,[7] and with the inspired reflection on this teaching in Romans, I Corinthians, and I Peter in particular,[8] we may derive certain basic guidelines for the Christian, which may be divided into actions that Christians are required to take and actions that Christians are forbidden to take.

In brief summary, Christians are required to love

their enemies, pray for those who persecute them, bless those who persecute them, do good to those who hate them, bless those who curse them, be merciful, obey the commandments of Christ, feed their enemies if hungry, give their enemies something to drink if thirsty, overcome evil with good, and rejoice insofar as they share Christ's sufferings. In the same way, Christians are forbidden to do anything that results from the desire for retaliation, put the safety of their lives above that of service to Christ, fight (in physical violence) for the cause of Christ, return evil to someone else for evil inflicted on them, avenge themselves for wrong inflicted on them, allow themselves to be overcome by evil, or incur suffering because of doing wrong.

Christians may be willing to sacrifice themselves rather than respond violently to the perpetration of evil, but do they have the right (duty?) to sacrifice the lives of others as well?

If we put all of this biblical teaching together, we have one of the most incredible claims ever made: ultimate victory over evil even in this most sinful world can be achieved only through self-giving and active love. It is not that we should love only those who are part of our family, community or nation—we should, of course—but our enemies as well. It is not that we should exercise love as long as we can without suffering as a consequence—but without end. It is not that love will carry us only so far in a sinful world and that after that we must resort to force and violence, but that if we seek genuine victory in Christ we must persevere in love far beyond the boundaries of human reason and "common sense" that has not come into fellowship with Christ.

Of course this is incredible to the earthly mind. Who would dare to be a peacemaker in the midst of a warring world that looks at peacemakers with contempt? Who would willingly suffer abuse and persecution for the sake of Christ when it could be avoided by violent resistance? Who would presume to attempt to love one's enemies without making some kind of semantic switch so that "love" really means "destroy"? Who would be so bold as to live in this world while holding fast to citizenship in another? Who can bring oneself to bless one's persecutors? To bring food to one who desires your destruction, or to offer drink to one who works for your abuse? Who could be so naive as to attempt to offer good in response to the evil poured upon him? Who would willingly forego his "rights" and suffer for someone unjustly?

Do we not find in Christ Himself the answer to all these questions?

If these guidelines do not seem very practical, perhaps it is because we don't really understand what God is doing in this world. There is nothing passive toward evil in these guidelines. We do not ignore evil as Christians; we are called to overcome evil with good. This requires all the sanctified creativity that we can bring to bear. Still, how alien these guidelines sound in our world. *Retaliation* is *the* thing in today's world. Is it possible to pass a day without newspaper, radio or TV speaking of efforts to retaliate somewhere in the world—and then to retaliate for retaliation?

Was Jesus wrong? The issue is a fundamental and serious one. Every aspect of the central Christian message testifies to the fact that a violent response to evil can only compound evil in the world, and not overcome it. Jesus died defenseless and alone on the cross in order that the good news of His Gospel might be preached and lived. When His disciples sought to fight to defend Him, He forbade them. The victory of the Resurrection was the open proclamation that self-giving love had triumphed over evil. To deny this central core of the Gospel is to run the danger of calling into question the very integrity of Jesus Christ and of the whole set of relationships and truths that Christians treasure in Him. To affirm it is to open the way for God to guide and rule our future.

We do not ignore evil as Christians; we are called to overcome evil with good.

And this, of course, is why there is a crisis of conscience for Christians in science when they contemplate the issues involved in their participation in the development of weapons intended for destruction. Whether such participation in a particular instance can in good conscience be defended is a matter for Christians in science to answer for themselves. Whatever the answer, however, it cannot be given with integrity unless the requirements for a Christian and the actions forbidden to a Christian are understood and followed as part of the decision.

The test question raised earlier may be repeated: "If a scientist would not approve the *use* of a process or

device *if* developed, shouldn't he refuse to work on its development?"

Religious Pragmatism

In all of these issues, no attitude is more common or more destructive than "religious pragmatism." We must be careful not to confuse "religious pragmatism" with "Christian realism." Let no one misunderstand this.

Christians must always be realistic in assessing the character of the world and the types of problems that they must face. Christians are not called to be visionaries, living in an otherworldly way that is inconsistent with the real nature of the world around them, but to be salt and light in this very real, sinful world. But what constitutes our understanding of reality must come to us from the biblical revelation, from the teaching and life of Jesus Christ.

"Religious pragmatism," effectively denies any real significance for the teaching and life of Christ in many of the situations of life.

"Religious pragmatism," on the other hand, effectively denies any real significace for the teaching and life of Christ in many of the situations of life. It is a view held by religious people, people who may indeed have made a commitment of one type or another to Jesus Christ, people who regard themselves and who are regarded as Christians. Such people say, "We know and understand the teaching of Christ. We value it as a noble ideal that we should all strive toward."

But . . . they then add, "Of course in this real, sinful world it simply won't work. Maybe in the millennium, but not now. Maybe in heaven, but not now. Now we have to do the practical thing—we have to lie to survive; we can't ask too many questions about the work we're employed to do; we have to be concerned about tomorrow and not about thirty years from now, about ourselves and not about others; we have to respond to violence with violence; we have to kill to maintain life; and we have to retaliate to be sure that we are respected." While claiming to be followers of Christ, they effectively deny everything for which He lived, died, and rose again. If "religious pragmatism" is right, then there is nothing of value left to Christianity. It becomes only a psychological comfort or an illusory ideal.

That is the reason that I close this discussion with an impassioned plea against "religious pragmatism." Let's not perpetuate the denial of Christ, which says: "I know what Christ teaches and I respect it, but I can find reasons—using anything from practical politics to interpretations of other portions of the Bible—not to do it."

Let's be honest with ourselves and with each other. Let's seek to know and understand the full message of Christ's life, death, and resurrection. And then let's get busy to see how best we can put it into practice in the world in which we live. Crises of conscience can be opportunities for service and witness.

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Comforting Job in the ICU: Ethical Issues in High Technology Medicine

DAVID L. SCHIEDERMAYER, MD

Assistant Professor of Medicine
Medical College of Wisconsin
Milwaukee, WI

Field studies of physician behavior in the ICU reveal a focus on the technological imperative rather than human comfort. This is a new phenomenon. A review of the history of ICU technology reveals that cardiopulmonary resuscitation, artificial ventilation, dialysis, intravenous feeding, and intensive care units have been developed within our lifetimes. Several criticisms of high technology are explored, and the ethical problems of ICU access, rationing, and statistical vs. identifiable victims are examined. The caring imperative in medicine preceded the technological imperative; the goals of medicine include the compassionate care of ICU patients.

Job continued his discourse:
Terrors overwhelm me;
my dignity is driven away
as by the wind;
my safety vanishes
like a cloud.
And now my life ebbs away;
days of suffering grip me.
Night pierces my bones;
my gnawing pains never rest.
My skin grows black and peels;
My body burns with fever.
(Job 29:1, 30:15–17)

Hospitals are places of pain and suffering, and intensive care units (ICU's) distill human agony. They are the places where we would find a modern Job, a patient with a life-threatening disease, who is febrile and possibly septic. In the modern ICU, patients are frightened and overwhelmed by the severity of their illnesses and the inescapable presence of high technology. Their dignity is "driven away as by the wind"—others regulate their bowels and bladders, examine, feed, wash, and turn them.

The ICU is a place where 73 percent of the patients are terminally ill, and where 15 percent of our health care dollar is spent,[1] where physicians employ therapies which are often extremely invasive and only potentially or marginally beneficial,[2] and where some of the most difficult ethical dilemmas in medicine arise.

The opinions expressed are those of the author and do not necessarily represent those of the institutions or foundations with which he is affiliated.

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Critical illness is often accompanied by loneliness and disorientation. Job describes the feeling: "my safety vanishes like a cloud." Unfortunately, studies reveal a dearth of opportunity for human comfort in the ICU. A survey of visiting policies in 78 ICU's in Ohio demonstrated that 25 percent allowed only 2 visits per day, and 42 percent restricted visits to under 20 minutes. Most units rarely or never allowed children under 12 to visit. The authors of the study point out that there is no empiric medical evidence which supports the need for these sorts of policies.[3]

Field studies of physician behavior in the ICU reveal a focus on laboratory evaluation rather than on patients; a lack of expression of personal feelings; and an excessive dependence on invasive technology.[4,5,6] One of these studies records an example of the focus on the status of the machinery instead of on the care of the patient.:

> A preadolescent boy, hospitalized with leukemia, became severely immunocompromised by his therapy. He developed pneumocystic carinii pneumonia and his condition rapidly deteriorated. He required ventilatory assistance . . . arterial cut-downs and a Swan-Ganz catheter. Numerous complications developed. One morning after a long and complicated presentation of serial blood gas determinations, pulmonary wedge pressures, intake and output, and similar material, a staff anaesthesiologist commented that everything 'seemed alright.' The weary resident who had made the presentation replied uncomfortably, 'Yeah, except the kid.'[4]

Providing comfort in these kinds of situations is our biblical imperative and our professional obligation. In this paper I examine the nature of intensive care and suggest some solutions for better comforting "Job" in the ICU. These solutions must consider access to the ICU and the limits of the technological imperative. Let's begin be examining the development of ICU technology.

The Development of ICU Technology

Thirty-five years ago a patient with failure of the heart, lungs, kidneys, or gastrointestinal tract died within a few minutes, days, or weeks. G.D. Phillips traces the development of life support systems as shown in Table 1.[7] Most technologies, such as CPR and artificial ventilation, were limited to animal experimentation until the 1920's and 1930's, and much of the actual development occurred after 1950.

External cardiac defibrillation began in 1956, and the use of mouth-to-mouth resuscitation became widespread in the late 1950's and early 1960's. However, there may be much older examples of resuscitation. Elisha put his full weight on the body of a dead child and put his mouth on the child's mouth, then repeated the maneuver; the child returned to life (2 Kings 4:32–35). Fourteenth-century patients who suffered cardiac arrest were whipped with nettles, and in the seventeenth century they were draped over a trotting horse, without reported success.[8] Choosing among these three techniques would be easy: the gentle touch and the effective prayer of the man of God would be my preference, and I would have wished to forgo resuscitation in the 14th and 17th centuries. Those readers who are sometimes concerned about the violent aspects of modern CPR may find its historical predecessors interesting!

Thus, we may draw the following three conclusions from our review of the development of ICU technology:

1. ICU technology as we know it has developed within our lifetimes.
2. There are mechanical emergency support or resuscitation systems for most of the vital organ systems except the brain and the liver.
3. Since 1958, intensive care has grown into a multidisciplinary and multinational discipline.[9]

The Critique of High Technology

Despite the benefits of ICU technology—improved survival for patients with trauma and critical illnesses—there has been increasing criticism of medical technolo-

David L. Schiedermayer, MD, practices general internal medicine at the County Hospital in Milwaukee and teaches clinical ethics to junior medical students on the wards. He has written and coauthored a number of papers on ethics, focusing primarily on the withdrawal of tube feeding, physician attitudes toward comatose patients, and the standard of care for ethics consultants. He also writes occasionally on medicine for The Christian Medical and Dental Society Journal *and* The Milwaukee Journal. *He has an interest in Third World medicine and part of his medical training occurred in Liberia, West Africa, at a small mission hospital.*

Table 1
The Historical Development of ICU Technology

Cardiopulmonary Resuscitation (CPR)	*Dialysis*
1847—Internal heart massage in cats	1923—First peritoneal dialysis in man
1901—Successful internal cardiac massage in a woman who collapsed during chloroform anaesthesia	1947—First hemodialysis
1947—Internal cardiac defibrillation	*Intravenous Feeding*
1956—External cardiac defibrillation	1800—Intravenous dextrose
1958—Mouth-to-mouth resuscitation	1920—Intravenous fats
Artificial Ventilation	1937—Intravenous amino acids
1776—Bellows for resuscitating the drowned	1968—Complete intravenous feeding
1932—Artificial ventilation in anaesthesia	*Intensive Care Units*
1940—First ventilator	1958—Baltimore City Hospital ICU
1953—Use of ventilator in polio patient	—Toronto General Hospital ICU
	1988—Over 5000 ICU's worldwide

gy. Several studies have shown that patients with acute myocardial infarction or acute pulmonary edema may survive just as well outside of the ICU as in it.[10,11] Data collected in the neonatal ICU confirm that gains have been made in the survival of infants with increasingly low birth weights—in the 1960's the limit for giving ventilatory support was 1500 grams, in 1970 it was 1000 grams, in 1975 it was 750 grams, and in the 1980's the limit is around 500 grams. The success, however, is not unqualified. Ventilatory management has been difficult, and multiple medical complications may occur. The tiny infant may have patent ductus arteriosus, immature brain and germinal matrix, and incomplete vascularization of the retina.[12] Increased attention and funding of neonatal intensive care technology may be diverting attention and funding from basic prenatal care and primary care pediatrics.[13]

Some outspoken critics of modern medicine, like Ivan Illich, question whether any significant gains have really been made in the recent technological revolution.[14] I must admit that as a physician I am taken aback by this kind of anti-technological sentiment. Like most clinicians, I am generally favorable to technological advances, because I see many of them help my patients on a day-to-day basis. Technology is a double-edged sword, but it often allows us to reverse physiological processes which threaten our patients' lives. We know adequate food and housing, proper sanitation, and childhood immunizations are more potent life-savers than are arterial lines. But arterial lines work very well if the patient is hypotensive and hypoxic. Why then the bitter critique of high technology?

The Problem of the Technologic Imperative

Perhaps we can find the answer in one of the most eloquent of the anti-technology voices, Christian philosopher Jacques Ellul. In his work, *The Technological Society*, Ellul makes the following points:

1. Ours is a progressively technical civilization.
2. The ever-expanding and irreversible rule of technology is extended to all domains of life.
3. Our civilization is committed to the quest for continually improved means to carelessly examined ends.
4. What was once prized in its own right now becomes worthwhile only if it helps achieve something else.
5. Technique turns means into ends.
6. "Know-how" takes on ultimate value.[15]

The problem, according to Ellul, is that technology does this without plan; it just happens, as a sort of technological imperative. ICU technology is used because it is the ultimate medical "know-how." Continual improvement in machinery is sought while the medical ends of the technology are only hastily examined. Ellul's critique must be acknowledged as at least partly valid. Better technological assessment is needed. The ends of medicine—prolongation of life, reduction of suffering, improvement of function—should be served by each technological advance.

The caring imperative in medicine preceded the technological imperative, and for all its science, medicine remains an art. Part of the art of modern medicine is the ability to use technology without being enamored with it to the detriment of the patient. "Know-how" is important, but should not take on ultimate value in medical care. We prize the patient in his or her own right as a person for whom Christ died. The patient is not the means for us to achieve our own ends (i.e., the testing and perfection of medical technology).

ICU Access & Rationing Systems

Thus, while we acknowledge the validity of some of the anti-technology arguments, it is more helpful to ask

how we can justly and humanely use the technology we have developed. There is voluminous literature on this topic. Physicians, for instance, can ration ICU care in response to resource shortages. In one case, a shortage of nurses decreased the ICU bed capacity from 18 beds down to 8 beds, and physicians responded by restricting ICU admissions to more acutely ill patients and reducing the amount of routine monitoring. As the bed shortage worsened, the percentage of patients with chest pain who actually had myocardial infarctions increased. The physicians admitted fewer "rule-outs." There was no increased mortality and no apparent withdrawal of care from dying patients.[16] In another study of 1151 ICU patients, during times of crowding patients discharged from the unit were sicker and younger. Older patients were less likely to be discharged than younger patients and, again, no adverse outcomes were reported. Surveying only ICU patients in these studies, however, may create a selection bias; the studies should focus on every patient in the hospital or the ER who *could* be an ICU candidate.[17]

Fourteenth-century patients who suffered cardiac arrest were whipped with nettles, and in the seventeenth century they were draped over a trotting horse, without reported success.

Many fascinating arguments can be made about who should have the "last bed" in the ICU: should there be a waiting line, or a lottery system, or should medical need take precedence? These arguments are not purely theoretical, as anyone who has tried to admit a critically ill patient from the ER to a full ICU can verify. There has been a court case involving Susan Von Stetina, a 27 year-old trauma victim who remains unconscious several years after being accidentally disconnected from a respirator at a time of an ICU night nurse shortage. The suit claimed the hospital failed to establish a priority system. One patient already in the ICU met the criteria for brain death, and 2 others were electively discharged in the morning. The jury ruled in favor of the plaintiff and awarded a verdict in the sum of $12,470,000. The Supreme Court of Florida has returned the case for a retrial because of the $4 million awarded for pain and suffering.[18,19]

Part of the art of modern medicine is the ability to use technology without being enamored with it to the detriment of the patient.

Should Job Be Admitted to the ICU?

Assuming that he met the medical criteria for admission, and that visiting policies were amended so that his friends could visit, should Job be admitted to the ICU? If we choose not to provide state-of-the-art care for Job—assuming we have some effective treatment for him—we are abandoning an identifiable human being. Part of our difficulty in rationing ICU care is that we distinguish between Job's life, which is identifiable, and a statistical life, which is only on paper. We may not be willing to put in a stoplight or install airbags to save statistical lives, but identifiable lives are traditionally regarded as worth saving at virtually any cost. Enormous sums are spent to rescue lost mountain climbers, trapped miners, and other visible victims.[20]

Technology is a double-edged sword, but it often allows us to reverse physiological processes which threaten our patients' lives.

Even if we decide to admit Job to the ICU, however, we may face difficult decisions ahead. Once in the ICU, the relationships between a patient's prognosis, resource expenditure, and clinical outcome become more complex than we often realize. Among nonsurvivors in the ICU, the highest charges are due to caring for patients who were perceived on admission as having the greatest chance for recovery. Among survivors, the highest charges were incurred by those thought to have the lowest chance of recovery. Patients with unexpected outcomes incur the greatest costs. Even making a patient a "no-code" does not necessarily decrease the costs, because such patients are usually the most critically ill.[21]

What would Job want? He would probably want to try the ICU. There is evidence that 70 percent of patients and families who had previously experienced ICU care would be willing to undergo ICU care again to achieve even one month of survival; 8 percent were

unwilling to undergo ICU care to achieve any prolongation of life. These data suggest that besides our perception of the enormous value of an identifiable life, patient preferences may also conflict with any policy that limits access to the ICU based on age, function, or medical diagnosis.[22] Thus, both sanctity of life considerations and patient preferences would most likely result in ICU admission for a patient like Job.

Should there be a waiting line, or a lottery system, or should medical need take precedence?

Compassionate ICU Care

The ICU is a frightening place, and too often we "comfort" the Jobs in our ICU's with the use of high technology alone. Technological comfort is expensive, and it does not address the frightening loss of control, dignity, and purpose experienced by the seriously ill patient: "Terrors overwhelm me." The ICU can become a place where doctors strive to outdo each other, where hospitals compete against each other, where money is made, and where patients suffer, often alone. Is there a better way? Let's go back to what we can learn from those who sought to comfort Job.

1. Job needed human understanding and sensitive spiritual counsel. This would seem to be important in the modern ICU. Often nurses provide excellent comfort care; physicians need to learn from them how to be more compassionate to ICU patients.

Both sanctity of life considerations and patient preferences would most likely result in ICU admission for a patient like Job.

Patients fear abandonment. Patients need a sense of control, a sense that we are respecting and honoring them. We need to pay more attention to the patient rather than concentrating solely on the data. We need to be sensitive to patients' spiritual needs, and if we are not comfortable addressing them, we need to enlist the help of the clergy or the hospital chaplain.

2. While we should attempt to use appropriate technology, we need to recognize when technology is futile and when it may no longer serve us but rather threatens to become our master. Professional ego, fear of litigation, competition, and remuneration are entwined with the use of high technology in many circumstances. The critics of technology rightly argue against these reasons for its use.
3. Despite the legitimate criticism of high technology medicine, the ICU care of Job and patients like him reflects a sanctity of life view of human beings as identifiable persons whose lives are worth saving despite the odds and the cost. Furthermore, ICU care upholds a traditional medical value which is being increasingly attacked, that of "merely" prolonging life.

We need to recognize when technology is futile and when it may no longer serve us but rather threatens to become our master.

Conclusion

If I were Job's doctor, I would admit him to the ICU and let his friends and family visit him, although I might ask the hospital chaplain to see him also (just in case his friends gave him bad advice!). I would use appropriate technology to treat his infection, skin disease, and fever, and I would prescribe pain medication to control his "gnawing pains." I would encourage the nurses to sit with him, and I would try to do the same. If, in my clinical judgment, Job was dying despite ICU care, I would speak with him and his family and work out a treatment plan which would emphasize support and comfort, and I would assure him that I would not abandon him.

But, on occasion, I might hope for the best:

> After this, Job lived a hundred and forty years;
> he saw his children and their children
> to the fourth generation.
> And so he died, old and full of years.

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Communications

On Cellular Automata and the Origin of Life

In a recent issue of this journal Robert C. Newman presented a very interesting account of self-reproduction in cellular automata.[1] He was concerned particularly with a simple self-reproduction model that was developed by Christopher Langton.[2,3] Newman argues that Langton's device is at or near the minimum complexity for self-reproduction of any meaningful form. He then goes on to argue that even for this very simplistic model of life, in the most favorable conditions, the chances of such a device occurring by chance are vanishingly small. Hence, since life itself is even more complicated, this amounts to very strong evidence that life is designed.

In this paper, we present a self-reproducing automaton that shares the basic features of Langton's model but is much simpler.

Langton's Automaton

For a detailed description of Langton's automaton we refer the reader either to Newman's account or to Langton's papers. What follows here is only a brief sketch.

In designing a machine that could reproduce itself, Langton considered a two-dimensional array of cells, each cell being in one of eight possible states. The state of each cell at any time is determined by the states of itself and its four nearest neighbors at the previous time-step.

```
  2 2 2 2 2 2 2 2
2 1 7   1 4   1 4 2
2   2 2 2 2 2 2   2
2 7 2         2 1 2
2 1 2         2 1 2
2   2         2 1 2
2 7 2         2 1 2
2 1 2 2 2 2 2 2 1 2 2 2 2 2
2   7 1   7 1   7 1 1 1 1 1 2
  2 2 2 2 2 2 2 2 2 2 2 2 2 2
```

Figure 1

Langton's device is shown in Figure 1. It essentially consists of a signal that contains the information necessary to make a copy of itself, guided by two walls. The zero state (represented by a blank) is the quiescent state. States 1 and 2 guide the signal: 1 is an element of the data path, 2 is an element of the wall protecting the signal. The remaining five states are used as signals. To specify the direction of the signal, the digit following a signal is set to state 0. When a signal approaches a junction, it splits into two copies of itself, one along each path. The data path is lengthened by one unit when a 7–0 signal reaches the end; a left hand corner is made when two 4–0 signals hit the end in succession.

With these rules, and others for states 3, 5 and 6, the configuration shown in Figure 1 first extends its arm by six units. Then it turns left, adds another six units, turns left again, adds six more units, and turns left a third time. Then it closes in on itself. States 5 and 6 are next applied to disconnect the new loop and to start the process over again. After 151 time steps we have two loops, each of which starts to form a new loop. The loops continue to reproduce themselves until all the available space is used up.

Newman estimates the complexity of this device by considering only those cells in the initial configuration which are in a non-zero state (86 cells) and only those transition rules that yield a non-zero state (190 rules). Assuming that all states are equally likely to arise by chance he finds that the number of possible random combinations is 7^{86+190}, or 2×10^{233}. Since we have four possible rotations, this leads to a probability of one out of 5×10^{232} that this automaton could arise by chance.

A Simple Automaton

The question arises whether the above automaton is indeed at or near the minimum possible complexity for self-reproduction. In searching for simpler solutions, we will adhere to the criterion stated by Langton: we should take seriously the "self" of "self-reproduction," and require of a configuration that the construction of a copy should be *actively directed* by the configuration itself.[2]

Thus, we rule out trivial cases of "reproduction" that are generated solely by the transition rules. For example, we could construct a configuration where a cell could have one of two states (0 or 1) with two transition rules: a 0 surrounded by three 0's and one 1 becomes a 1, and a 1 surrounded by three 0's and one 1 becomes a 0. Then,

starting with a 1 in a field of 0's, the 1 will appear to reproduce itself (see Figure 2). But this we do not consider as *self*-reproduction.

time = Ø	time = 1	time = 2
0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0 0 0
0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 1 0 0 0
0 0 0 0 0 0 0	0 0 0 1 0 0 0	0 0 0 0 0 0 0
0 0 0 1 0 0 0	0 0 1 1 1 0 0	0 1 0 1 0 1 0
0 0 0 0 0 0 0	0 0 0 1 0 0 0	0 0 0 0 0 0 0
0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 1 0 0 0
0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0 0 0

Figure 2

As stressed by Langton, we want to require that the responsibility for reproduction resides primarily with the parent structure. But not totally: the structure may take advantage of certain properties of the "physics" of the interactions as this is represented by the transition rules.

Keeping these considerations in mind, we now present a simplification of Langton's automaton. The first modification is to eliminate the inner wall. The second simplification is to use just one 4–0 signal to make a left turn. The third change is to determine the direction of the signal not by an x–0 combination, but by the orientation of each cell with regard to that neighboring cell having the lowest state. In order to ensure that this neighbor will normally be a segment of the outer wall, we assign the blank quiescent cells a numerical value of 7. Then we specify that, unless otherwise stated, the successor to states 3, 4, and 6 will be the state of the nearest cell clockwise from the smallest neighbor. The default for states 1, 2, 5, and 7 will be that the previous state remains unaltered.

The functions of the various states are as follows: state 2 refers to a segment of the wall, state 1 represents the segment of the wall at a junction (this is needed to keep the signal cycling within the configuration), state 3 defines the data path, 6 is used to add a unit to the data path, 4 forces a left turn, and state 5 is used to close the new loop and to initiate the formation of a further copy. Figure 3 shows a signal (i.e., 6634) cycling inside the wall of a small configuration.

time t	time t + 1	time t + 2
2 2	2 2	2 2
2 6 6 2	2 6 3 2	2 3 4 2
2 4 3 2	2 6 4 2	2 6 6 2
2 2	2 2	2 2

Figure 3

The numbering in this model is somewhat different from that used by Langton. This is partly due to the fact that the numbering is used to derive the orientation, and partly because we require only 7 states rather than the 8 used by Langton.

With these modifications it is possible to construct a simple initial configuration with only 12 cells which reproduces itself after 25 time-steps, as shown in Figure 4. The program used (based on Newman's program and written in

time = 0	time = 1	time = 2	time = 3	time = 4	time = 5
22	22	22	22	22	22
2632	2342	2462	2662	2632	2342
2642	2662	2366	24363	26436	266633
25	225	225	225	2252	2212
time = 6	**time = 7**	**time = 8**	**time = 9**	**time = 10**	**time = 11**
22	22	22	22	22 3	22
2462	2662	2632 3	2342 6	2462	2662 3
23666	243666	2643663	2664366	23664363	24366436
22122	22122	22122	221222	221222	2212222
time = 12	**time = 13**	**time = 14**	**time = 15**	**time = 16**	**time = 17**
22	22	22	22 3	22	22 3
2632 3	2342 3	2462 63	2662 3	2632 62	2342 3 32
264366433	26643664	236643662	243664362	264366432	266436642
2212222	22122222	22122222	2212222	2212222	2212222
time = 18	**time = 19**	**time = 20**	**time = 21**	**time = 22**	**time = 23**
22 2	22 3 22	22 2	22 22	22 22	22 22
2462 6 42	2662 62	2632 362	2342 5332	2462 2342	2662 2462
236643662	243664362	264366432	266436642	236645662	243652362
2212222	2212222	2212222	2212222	2212222	2212522
time = 24	**time = 25**	**time = 26**	**time = 27**		
22 22	22 22	225 22	265 22		
2632 2662	2345 2632	2462 2342	2662 2462		
2645 2432	2662 2642	2362 2662	2432 2366		
2212 52	22 2 25	22 225	22 225		

Figure 4

Quickbasic 4.0) is listed in the appendix.

After 25 steps, the original configuration and the daughter have the same form as the initial array. Then, as in the case of Langton's automaton, the daughter forms a new copy toward the right, while the original has turned 90 degrees and makes a copy toward the top of Figure 4. The process continues until all the available space is covered with copies.

The total number of transition rules used (see the program) is 36 plus the 7 default rules, for a total of 43. Applying the same Newman calculation as above, the number of random combinations of 12 cells and 43 rules of 7 possible states is 6^{12+43} or 6×10^{42}. Since there are at least 2 acceptable initial arrays (see time frames 0 and 24 in Figure 4) with 4 rotations each, the resultant probability is one out of 8×10^{41}.

The Origin of Life

Newman estimates the probability of life occurring by chance as follows. Suppose that both the cells and transition rules in Langton's automaton correspond to atoms and that the different states refer to different elements (e.g., state 1 = carbon, state 2 = nitrogen, etc.). Then assume that all the atoms in a given volume of the universe are forming only 276-atom chains (86 cells plus 190 rules). Under the most favorable conditions, Newman estimates that there are in the entire universe at most 7×10^{73} chains forming at a rate of 8×10^{11} per second. The time to form 5×10^{232} chains is then given by $(5 \times 10^{232})/((7 \times 10^{73})(8 \times 10^{11})) = 10^{147}$ seconds, or 3×10^{139} years. On the basis of this immense timespan, Newman concludes that we have found very strong evidence that life is designed.

I wonder, parenthetically, whether this calculation is realistic. The main issue is whether the transition rules should be included in the probability calculations. I agree with Newman that a great part of the complexity is hidden in the transition rules. But should not at least a fraction of these rules be attributed to the operation of physical and chemical laws? Such laws can surely be assumed to be fixed and not determined by chance.

However, even if we grant the validity of Newman's probability analysis it is clear that his argument for design falls short. For on the basis of the simple (12 cell) automaton presented in this paper, the above form of calculation leads to a timespan of only 5×10^{-45} seconds.

It must be stressed that life is considerably more complex than the simple mechanisms discussed in this paper. In fact, I suspect that Newman is right in his conclusion that the chance occurrence of life is virtually impossible. Yet, such conclusions must be founded on stronger evidence than that presented by Newman. Such evidence does exist: more sophisticated calculations indicate that, on the basis of currently known physical laws, the probability of life arising spontaneously is extremely small.[4]

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[3]Christopher G. Langton, "Studying Artificial Life With Cellular Automata," *Physica 22D* (1986):120–149.

[4]See, for example the calculations of E. Argyle, "Chance and the Origin of Life," *Origins of Life 8* (1977):287–298; H.P. Yockey, "A Calculation of the Probability of Spontaneous Biogenesis by Information Theory," *Journal of Theoretical Biology 67* (1977):377–398.

John Byl

Department of Mathematical Sciences
Trinity Western University
Langley, B.C.
Canada V3A 6H4

APPENDIX: A Basic Program for Self-Reproductive Cellular Automata

```
REM program "CELL": program for self-reproduction in cellular automata
        DEFINT A-Z
        DIM a(42,42), tr(7,14), t(7,14), z(42,42), f(7), n(4)
        DATA 1,2,-3,-3,5,-3,7
REM transition rules
1       DATA 2527,7,,
2       DATA 2277,7,2357,5,2527,5,2657,6,2727,7,3577,5,7777,7
3       DATA 4677,3,4777,7,6777,6,7777,7
4       DATA 2365,6,2576,5,,
5       DATA 1724,2,2227,7,2276,7,2327,1,2426,2,2477,2,2774,2
        DATA 3776,2,,
6       DATA 1523,5,1777,2,2635,3,2653,5,2657,6,,
7       DATA 1776,2,2577,5,2773,2,2774,2,2776,6,3577,2,3677,3
        DATA 3776,6,6777,3,,
REM initial array data
        DATA 7,2,2,7
        DATA 2,6,3,2
        DATA 2,6,4,2
        DATA 7,2,5,7
        READ f(1),f(2),f(3),f(4),f(5),f(6),f(7)          read in default rules
        FOR i = 1 TO 7
```

```
100         FOR k = 1 to 14                                          read in transition rules
            READ t(i, k), tr(i, k)
            IF t(i, k) = 0 THEN t(i, k) = 9999
            IF t(i, k) >= 7777 THEN 110
            NEXT k
110         NEXT i
          ymax = 10                                                  set field size
          xmax = 14
          FOR y = 0 TO ymax-1                                        initialize cells at 7
            FOR x = 0 TO xmax-1
              a(x, y) = 7
              NEXT x
            NEXT y
          FOR y = 1 to 4                                             read in configuration
            READ a(2,y),a(3,y),a(4,y),a(5,y)
            NEXT y
          time = 0
120       PRINT "time = ";                                           print time
          PRINT USING "###"; time
          FOR y = 0 TO ymax-1
            FOR x = 0 TO xmax-1                                      print field
              IF a(x,y) <> 7 THEN 130
              PRINT " ";
              GOTO 140
130           PRINT USING "#"; a(x,y);
140           NEXT x
            PRINT " "
            NEXT y
          FOR y = 0 TO ymax-1
            FOR x = 0 TO xmax-1                                      find successor to a(x,y)
              c = a(x, y)                                            assign center
              n(0) = a(x, (y+ymax-1)mod ymax)                        assign neighbors
              n(1) = a((x+1)mod xmax, y)
              n(2) = a(x, (y+1)mod ymax)
              n(3) = a((x+xmax-1)mod xmax, y)
              small = 20
              FOR k = 0 to 3
                IF n(k) > small THEN 200
                small = n(k)
                s = k                                                find smallest neighbor
200             NEXT k
REM orient neighbors so that smallest one is on the bottom
              IF n((s+1)mod 4) = small THEN s = s+1
              IF n((s+1)mod 4) = small THEN s = s+1
              IF n((s+2)mod 4) = small AND n((s+1)mod 4)_
                                          < n((s+3)mod 4) THEN s = s+2
REM determine appropriate transition rule m
              m = 1000*small + 100*n((s+3)mod 4) +_
                    10*n((s+2)mod 4) + n((s+1)mod 4)
              l = n((s+1)mod 4)                                      find neighbor on left
              j = 1
210           IF t(c, j) <> m THEN 220
              z(x, y) = tr(c, j)
              GOTO 250
220           IF t(c, j) <= m THEN 240
              z(x, y) = f(c)                                         if required use default
REM if default < 0 use cell on left
              IF z(x,y) < 0 THEN z(x,y) = 1
              GOTO 250
240           j = j + 1
              GOTO 210
250           NEXT x
            NEXT y
          FOR y = 0 TO ymax-1                                        replace old array
            FOR x = 0 TO xmax-1
              a(x, y) = z(x, y)
              NEXT x
            NEXT y
          time = time + 1                                            adjust time
          GOTO 120
```

The Functional Dependence of Reason on Faith in Theology and Science: An Epistemological Symmetry

Judeo-Christian theology and science ask very different questions and use different procedures, while the uniqueness of each enterprise arises as a direct consequence of the different natures of the principal object of investigation in each field. Science concerns itself with understanding the intelligibility revealed in the structures of the physical universe, while theology attempts to understand how the transcendent Creator of this universe has revealed himself to human observers in the space-time structures in which both theologian and scientist live. Nevertheless, at the epistemological level, a symmetry exists between theology and science as both are grounded in "faith seeking understanding."[1] This epistemological symmetry between the two disciplines is clearly seen in the functional dependence of *reason* on *faith*.

SCIENTIST: *Faith* in the order, unity, and intelligibility revealed in nature mobilizes *reason* to seek comprehensive understanding of physical reality by *observing, experimenting, hypothesizing*, and *revising* (explication of revealed, contingent intelligibility). As reason is mobilized, all four of its processes are grounded in and sustained by regulative commitments arising from whole-person experience of physical reality's subtle intelligibility.

THEOLOGIAN: *Faith* in the revelation of Jesus Christ faithfully, uniquely, and authoritatively witnessed to in Holy Scripture mobilizes *reason* to seek comprehensive understanding of such revelation by *exegeting* Holy Scripture (whose words are indwelt by the Word), *living* a life of grateful service to God, prayerfully *formulating* doctrinal statements, and *revising* all such doctrine (explication of revealed, transcendent intelligibility). As in science, all four reasoning processes are grounded in and sustained by regulative commitments now arising from whole-person experience of the presence of the living Lord as promised by Holy Scripture. "God is love" calls forth appropriate responses of creaturely love by humankind toward God and one's neighbors. Note that such love of God and neighbor involves the stewardship of God-created physical resources, animate and inanimate.

The following comments are intended to clarify the nature of the four processes of theology's scientific method.

1. Exegeting

Exegesis is a critical interpretation of a portion of Holy Scripture in order to best understand what the text meant in the context of its own time, and how that meaning applies to our time. From such exegesis Holy Scripture becomes a faithful witness to God's self-revelation in Jesus Christ for every age. Exegesis becomes possible when the exegete is open to the possibility that the words of the text bear witness to historical events and teachings that point beyond themselves to the activity of God, whose loving faithfulness grounds such events and teachings in a transcendent purposefulness. The exegete acquires such an attitude of openness through participation in a worshipping community whose attitude toward Holy Scripture, explicit and tacit, is one of reverence, respect, and belief that God will speak to us through its words.

Although the parallel between exegesis and observation in natural science is not exact, observation is also a critical interpretative process in which, as the human observer encounters a complex image of sensory experience, details are selected out that hint at possible patterns suggestive of a hidden unity. Observation in science is meaningful when the observer is open to the possibility that features of physical reality, perhaps not before considered significant, point beyond themselves to hidden patterns which are the manifestation of a unitary structure grounded in contingent intelligibility. Such observational openness is always conditioned by theory, in that the selectivity to recognize significant sensory experience is grounded in the observer's commitment to prior theoretical understandings and criteria of scientific rationality upon which to question such understandings. This conditioned openness toward sensory experience of physical reality is best learned by serving an apprenticeship in a research community where guiding convictions and observational skills are tacitly absorbed through ongoing participation in scientific research with creative scientists.

2. Living

Living is a form of testing, of "experimenting with" the variety of relational patterns toward people and things established in Jesus Christ's unique servant lifestyle as witnessed by Holy Scripture. The resulting experience of God's sustaining presence and gentle power motivates the theologian to seek explanatory concepts and principles that lead to a greater understanding of God's activity and appropriate human responses. From such activity, integrated with biblical exegesis, doctrine develops.

3. Prayerfully[2] Formulating

Formulations of doctrinal statements arise from the interaction and mutually reciprocal critique of the leading insights of contemporary culture and past-to-present theological reflection upon God's creative, reconciling, and redemptive activity manifest in the unity of Jesus Christ's acts and words. A proper theology results from the theologian's responsive living under God's Word as witnessed to primarily in Holy Scripture and secondarily through tradition, personal experience (corporate and individual), and reasoned reflection. All such witnesses are manifestations of the activity of the Holy Spirit in the theologian's life.

4. Revising

Revisions of all doctrinal statements by the standard of Christ's life, word, and deed, as witnessed to in Scripture, are made in order that such doctrine may shed light on current problems in ways faithful to the Word in the biblical words.

It is important to recognize that while faith is essential to both science and religion, religious, specifically Christian, faith is epistemologically of much deeper dimensionality

than faith as manifest in science. Christian faith in its fullest sense is a totalistic life-transforming and life-directing commitment to Jesus Christ; such total commitment has a depth that is not usually paralleled by a similar commitment on the part of the scientist. It is possible that good scientists can recognize the faith-character of the postulates required in their scientific work. Such scientists can even affirm the necessity of making these assumptions. In short, they can share fully the faith of the scientific community and yet, outside the laboratory, they can be hedonistic nihilists, supporters of reactionary causes (right or left wing), apathetic "silent majority" types, *etc.* Such a person's faith as a scientist lacks the totalistic life-transforming and directing quality of faith in its deepest religious, specifically Christian, dimension. Faith in any scientific discipline is governed by the object of that discipline. Theology's Object-Subject, the Living God (Yahweh: I am who is always near), motivates us toward a uniquely personal commitment to him, other persons, and the rest of Creation. Such a commitment structure is far richer than the commitment imposed upon us by the objects of natural science in themselves.

Documentation is substantial with respect to the thesis that theology and natural science are both forms of "faith seeking understanding."[1] This note suggests that one striking representation of this consequence is the structural symmetry existing between faith-motivated and grounded human reasoning processes by which theologians and scientists alike conduct their exploratory activities. As one example of this congruence between reasoning processes in both fields, the comment on exegesis and observation has indicated possible parallelisms for both processes. Although the parallels are not exact due to the distinctiveness of each discipline's object (i.e., physical reality and the living, Creator God), they nevertheless exist. It has been pointed out that theologians and natural scientists do their research in very different settings.[3] Scientific work takes place most often in a laboratory whereas theological research seems confined to library and study. Closer inspection, however, reveals that theological work also has a laboratory component, its "laboratory" being the life of worship of a church community engaged in being a servant-witness to the world outside it. The personal interactions between fellow believers and their non-believing friends constitute the "experimental" component of theological science. It is hoped that a greater recognition by scientists and theologians alike that their respective methodologies are symmetrically mobilized by and grounded in regulative convictions (arising from and molded by each discipline's distinctive object, or Object-Subject) will encourage a greater dialogue between the two communities. Such dialogue could begin by examining the premise that each discipline's regulative beliefs are related to the others in specific ways with a better understanding of these relations reinforcing and modifying the insights gained by both disciplines.

NOTES

1. The following materials provide detailed documentation for the thesis that natural science and theology may be looked upon as disciplines rooted in "faith seeking understanding."
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W. Jim Neidhardt

Physics Department
New Jersey Institute of Technology
Newark, NJ 07102

Science and Martyrdom

> In one experiment, M. Curie caused a relatively weak radioactive product to act upon his arm for ten hours. The redness appeared immediately, and later a wound was caused which took four months to heal. The epidermis was locally destroyed, and formed again slowly and with difficulty, leaving a very marked scar.[1]

Pierre Curie did not die from his experiments with radioactive materials, though that might have been his fate if he had not been run down by a horse-drawn wagon in the streets of Paris. Marie Curie's health *was* seriously affected, and her life probably shortened by her long work with radioactivity. In those same years at the turn of the century when the Curies and others were being exposed to dangerous radiation dosages in their studies of newly discovered and imperfectly understood radioactivity and X-rays, Jesse Lazear and Clara Maass were dying of yellow fever as a result of investigations into the causes of that disease and searches for its treatment.

We find injury and death as a result of scientific research throughout the history of science. Marie Curie's life in one way paralleled that of Galileo, whose blindness in old age was probably caused in part by direct observation of the sun with his early telescopes. In both cases, we might be tempted to say that "they should have known better," but that would be from the perspective of people who know the risks involved in what those pioneers were doing. It is in the nature of investigating new phenomena that one does *not* know the risks involved precisely because the phenomena *are* new.

Less well-known than Galileo or Curie is Richmann. He died repeating Franklin's famous kite experiment, after saying: "In these days even the physicist has an opportunity to display his fortitude."[2] Chemists may think instead of Scheele, one of the greats of the eighteenth century. His health was certainly affected by the toxic materials with

which he worked, though he was able to survive his discovery of hydrocyanic acid, and even reported on its taste![3] Many other investigators have not been so fortunate in their excursions into the unknown.

Recently, the world was stunned by the death of the *Challenger* crew. Most Americans, who had gotten accustomed to the idea that the space shuttle was as routine as a commuter train, hardly knew what to make of such a disaster. In one way, of course, we did have a right to be surprised and angry, because later investigations have shown that those deaths could have been avoided if reasonable care had been taken. But we also need to realize that people have often taken a very naive view of the risks involved in space exploration, and in scientific research in general. Soviet cosmonauts and American astronauts had died in the line of duty before the shuttle explosion and, if the exploration of space continues, we can be sure that there will be other deaths. Who ever promised that the investigation of the universe was going to be easy?

A phrase like "martyrs of science" might call up a picture of Galileo being forced to recant, or of Soviet geneticists being persecuted because of their acceptance of Mendel's laws. That is indeed one type of risk which scientists have had to face. But one need not be regarded as dangerously unorthodox; one need not encounter persecution in order to find danger in science. The active investigation of the world, which is what modern science is all about, is risky. Anyone today working in a laboratory in which AIDS is studied is well aware of that. Even volunteers for a psychology experiment may in some circumstances be exposed to danger.

Of course we want the space program, and in fact all research, to be as safe as possible. No society which respects human life will have it otherwise. (And even a society which has no particular respect for human life in itself will probably want to avoid squandering one of its most important resources, its scientists and engineers.) In much the same way, the Christian Church has always highly honored its martyrs who have died for their faith, but has also condemned those who *try* to get themselves killed for being Christians. The words, "When they persecute you in one town, flee to the next" (Matthew 10:23), suggest that martyrdom is to be avoided if that can be done in a way consistent with one's faith.

We would have to make a similar judgment in the case of science. Doing an experiment without adequate safety precautions is simply foolish, and it is wrong to subject others to risks without their knowledge and consent in the name of science. But in some scientific fields, to insist upon total safety would be to forego the possibility of any advancement. It is not always possible to foresee the dangers which might arise in an investigation, and in some cases (as with attempts to develop treatments for diseases) it may well be felt by the people who are involved in the work that the unavoidable risk associated with a line of research is worth facing.

There would seem to be much more involved here than the mere possibility that things may go wrong. A person does not have to be a scientist like Pierre Curie to be killed in a traffic accident! Of course it is true that all of life is risky, but we are glimpsing another truth at least as deep as that. The scientific enterprise involves a certain forgetfulness of self, and a willingness to put the pursuit of the truth about the world ahead of personal comfort and even of personal safety. It involves at least potentially the willingness to risk one's life in order to know something about the nature of reality.

Plato was not primarily concerned with the search for knowledge about the physical world. But there may be a hint of this reality that we have glimpsed in the words he reports Socrates saying on the day of the death to which he had been sentenced because of his pursuit of truth: the philosopher must always pursue death and dying.[4] Even the scientist who does not see nature as God's revelation may risk health or wealth or life itself for a truth and beauty which is, in fact, from God, for God's gifts in creation are available for all (Matthew 5:45).

In the wisdom tradition of Israel we find the willingness to sacrifice oneself for Wisdom which *is* explicitly recognized as God's gift:

> I loved her more than health and beauty,
> and I chose to have her rather than light,
> because her radiance never ceases. (Wisdom 7:10)

It is through Wisdom that God gives understanding of the world:

> For it is he who gave me unerring knowledge of what exists,
> to know the structure of the world and the activity of the elements;
> the beginning and end and middle of times,
> the alternations of the solstices and the changes of the seasons,
> the cycles of the year and the constellations of the stars,
> the natures of animals and the tempers of wild beasts,
> the powers of spirits and the reasonings of men,
> the varieties of plants and the virtues of roots;
> I learned both what is secret and what is manifest,
> for wisdom, the fashioner of all things, taught me.
> (Wisdom 7:17–22)

In the New Testament Jesus Christ, the Wisdom of God (I Corinthians 1:30), calls people to follow him in the way of the cross. The scientist who is a Christian may move into unknown territory, knowing that there are risks involved, but also that the God whose truth is being sought is the God of the cross and resurrection.

Science and technology may also be means of service to humanity and to the whole creation. Thus, intelligent risk-taking in their pursuit can be a following of the pattern given by the Incarnate Wisdom of God in John 15:13. This should come as no surprise to those who believe that the God revealed in the universe is the Crucified One.[5] If that is the case, all approaches to the truth about creation will to some extent carry the sign of the cross.

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[1]Marie Curie, *Radioactive Substances* (New York: Philosophical Library, 1961), p. 67.
[2]Quoted in John L. Heilbron, "Franklin's Physics," *Physics Today*, July 1976, p. 36.

SEARCH

Scientists Who Serve God

SHE SOLVES CHEMICAL PUZZLES

At Lilly Research Laboratories in Indianapolis, Ann Hampton Hunt's title is Research Scientist. She has a Ph.D. in physical chemistry, and within that field her specialty has been nuclear magnetic resonance (NMR) spectroscopy (pronounced speck-TRAHSS-kup-ee).

Ann Hunt is thus an "N-M-R speck-TRAHSS-kup-ist," a mouthful even in its abbreviated form. Although she lives "out in the countryside" in Indiana, she seems to have come a long way from her birthplace in rural Lexington, North Carolina. She grew up on a family farm near Denton, North Carolina.

Ann's parents provided a lot of educational encouragement for Ann and her sister and brother. Her mother was a former high school science teacher and her father operated a poultry hatchery and feed store. "At times Dad was his own best customer," Ann recalls. He had a degree in agricultural education and liked both farming and teaching. Eventually he completed an Ed.D. at Duke University and became president of a community college.

Beginning a research career

A good background in mathematics is an asset in almost any branch of science. Ann entered the University of North Carolina at Greensboro as a math major, later switched to chemistry. After graduating with Phi Beta Kappa honors, she continued in chemistry at Duke. In graduate school she studied chemical reactions with the aid of NMR, then a relatively new technique. Ann completed the Ph.D. requirements in August 1969 and began teaching chemistry at Converse College in South Carolina. Her degree was awarded at Duke's commencement exercises in May 1970.

Hunt spent the summers of 1970 and 1971 doing research at Louisiana State University in Baton Rouge, in a program for college teachers funded by the National Science Foundation. In fall 1971 she took a postdoctoral research position at the M. D. Anderson Hospital & Tumor Institute in Houston, Texas, where she worked for two years on biochemical problems.

Moving to Massachusetts, the young chemist enrolled at Gordon-Conwell Theological Seminary, first as a full-time resident student, then as a part-time student, earning a Master of Theological Studies degree in 1976. Ann supported herself first by teaching part-time at North Shore Community College in Beverly, then as a research fellow in biochemistry at Harvard Medical School. In 1978 she went to work for the pharmaceutical firm of Eli Lilly & Co., and was promoted to her present title in 1983.

A life of discovery

Ann Hunt's laboratory at Lilly uses NMR spectroscopy and other sophisticated analytical tools to help company scientists figure out exactly what compounds they're working with. The two-dozen papers Dr. Hunt has published in chemical journals are full of names like actaplanin, N-methylstreptothricin, and "3-oxa-5-carba analogues of *beta*-lactam antibiotics." (For *their* pronunciation, you're on your own.) She finds the work challenging, often exciting, sometimes tedious and difficult.

Yet Ann Hunt is one scientist able to look beyond technical details to a bigger picture of what life is all about. Her master's degree in theology helps her focus on eternal dimensions, but the key factor is an abiding personal faith, held since her college days. One might say that Ann has lived a life of discovery outside the lab as well as in it. And at the very beginning of her scientific career, Ann Hunt discovered Jesus Christ.

Ω

Scientific Investigation

PUTTING CLUE AND CLUE TOGETHER

Chemists love to draw structural formulas of the molecules they work on. Since molecules are too small to see, how do chemists know what to draw? They get clues by using probes, like somebody who throws rocks into a dark cave, then tries to decide from the growls what kind of animal is in there.

When a chemical compound absorbs electromagnetic energy, the frequencies it absorbs give clues to its structure. For example, molecules built in certain ways show color because they absorb visible light of other colors. When higher-energy ultraviolet frequencies (UV) or lower-energy infrared frequencies (IR) are absorbed, chemists obtain other kinds of structural information. (*Spectrum*, a range of frequencies, is singular; *spectra*, plural.)

How nuclear magnetic resonance works

In NMR spectroscopy, radio-frequency energy of about 60 MHz (megaHertz, or million cycles/sec) is beamed into a compound held in a very strong magnetic field. Certain atoms have a nucleus (the N in NMR) with a property called "spin" that makes it behave like a tiny magnet (the M). Fine tuning of the radio frequency can make such nuclei reverse their N and S poles. That flip-over process absorbs energy at a specific resonance frequency (the R), recorded by the NMR spectrometer.

NMR is especially useful because (1) most organic compounds contain lots of hydrogen (chemical symbol, H); (2) the nucleus of the H atom (a single proton) has the spin property; and (3) the resonance frequency of each H atom shows a "chemical shift" depending on what that atom is attached to. So, each hydrogen-containing compound yields a unique NMR spectrum of absorption peaks. From the size of the peaks, a chemist like Ann Hunt can "count" the number of H atoms at each chemical shift. What's more, she can compare a compound's NMR spectrum with the spectra of known compounds to see what kinds of adjacent groups of atoms could produce each NMR peak in the spectrum of the mystery compound.

Solving riddles of chemical structure

Many pharmaceuticals are synthetic compounds. Others are "natural products" from animals, plants, or bacteria. Chemists in a company like Lilly may want to know if the "new antibiotic" they've isolated from a fermentation broth is really new. That's the easier part of Ann Hunt's job, getting an NMR "fingerprint" and comparing it with the spectra of known antibiotics.

Hunt's job is more challenging when she has to intrepret a spectrum to identify an unknown compound. She recalls one puzzler that was a potentially important drug. It was known to block a certain disease process but its structure was a mystery. On a holiday, Ann went to her lab to wait for the city's fireworks display to begin. She sat at her desk studying the complex NMR spectrum one more time. At last certain features began to fit together. She kept testing her ideas until finally the whole structure fell into place.

"That one was really exciting," she says, "like fireworks going off inside my head. I drew the structure that fit all the data and stuck it on the doors of my colleagues' labs. By then the real fireworks display was beginning, so I went out to watch without even calling them to say I had found the answer."

Ann Hunt stands near the magnet (11.7 Tesla) while fellow ASA member Richard Justice operates the computer of a 500 MHz NMR spectrometer at the Lilly Research Laboratories.

"HUNTING" FOR NEW MEDICINES

The company Ann Hunt works for is one of the world's ten largest pharmaceutical companies (once called "drug houses" without any bad connotations). Eli Lilly & Co. was founded in 1876 by a Civil War veteran fed up with the poorly prepared, ineffective medicines of his day.

Today the company sells its products in 130 countries. Most of those products were developed in its own laboratories, which now keep over 3,000 employees busy on as many as 50 potential new drugs at any one time. In 1926 Lilly opened its own clinic in an Indianapolis hospital to do clinical testing of the most promising ones.

Lilly once manufactured the insulin that keeps diabetics alive by laboriously processing animal pancreases. Lilly's human insulin (Humulin™), made by gene-altered bacteria, became the first pharmaceutical agent produced by recombinant DNA techniques to reach the market. Lilly also markets antibiotics, medicines to treat heart disease and clinical depression, and even some products used in agriculture.

Lilly spends over $500 million a year on research, but for any new drug to reach the market now requires an average of over $125 million spread out over eight to twelve years.

Theological Reflection

GOD CARES ABOUT DETAILS

Physicists and chemists can write precise mathematical equations describing the behavior of many things in the natural world. To discover such a "natural law" is an impressive but relatively rare accomplishment. Scientists spend much of their time simply tackling one puzzling problem after another. Even in routine tasks, though, they must pay attention to detail.

In that sense at least, Christian faith and scientific work have a lot in common. Theology may make grandiose statements about eternal truth, but without careful testing in individual lives, theological formulations have little practical value. Much of the time, Christians are engaged in honoring God by serving specific people in specific circumstances. That's the way theories about God are applied in real life.

Even a sparrow "counts"

Jesus once encouraged his disciples by telling them that God cared about sparrows priced at less than a penny each. He said that "even the hairs of your head are all numbered. Fear not, therefore; you are of more value than many sparrows" (Matthew 10:28-30). His heavenly Father didn't overlook small details. In one parable, servants who carried out a minor assignment were told that because of their faithfulness in little things they would be given greater responsibilities. Jesus then listed some "routine assignments" for God's servants: feeding people who hunger and thirst, clothing the needy, and caring for prisoners and the sick (Matthew 25:14-46).

"Taking care of business" in Christ's name means doing some things that may not seem of world-class importance at the time. But when Ann Hunt is working on a chemical structure, she does it with care whether or not that particular compound will ever make it to the marketplace as a new pharmaceutical agent. Similarly, she tries to serve God well outside the lab, whether on the national Council of the American Chemical Society or teaching an adult Bible class at Southport Presbyterian Church in Indianapolis.

Doing the job, and enjoying it

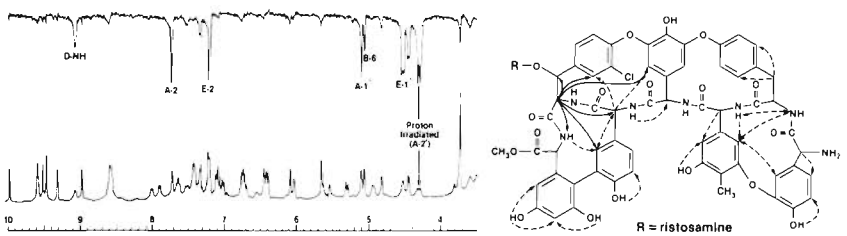
It is a privilege to be part of an enterprise as important as science, even in its routine aspects. The Christian enterprise offers a special sense of participating with God. Christians should *care* about what they do—because God cares how things are done.

Caring for people is often tough. Love that matters is not a grand feeling but a specific course of action in a real situation. To an outsider, some aspects of the Christian life must seem like "scut work." Yet to know Jesus Christ from the inside puts us in intimate touch with the Creator of everything that exists. To be alive to God's presence can make a world of difference in doing everyday tasks.

And, on occasion, it's like feeling fireworks in our souls.

Ω

At left, an NMR spectrum; at right, the structural formula of the compound that produced it. The solid & dotted arrows, not part of the structure, indicate special effects of nearby groups. Not all the hydrogen atoms in the molecule are shown by the symbol H. The R stands for part of the original molecule removed before obtaining the NMR spectrum.



THE NUMBERS GAME

Critics charge that few U.S. high school graduates are literate. Scientists worry because even fewer are "numerate." Science depends on mathematics.

Not everyone needs to understand higher math, but an ability to "play with numbers"—to think quantitatively—is useful in many situations. It is absolutely essential for anyone planning to study science. To get more Christian young people to enter scientific careers, we should encourage them to develop an early interest in math.

Numbers occur throughout the Bible, used both in a precise way and metaphorically for their symbolic value. Some interpreters construct complex schemes by assigning a numeric value to each Hebrew or Greek letter. With sufficiently flexible rules for manipulation, elaborate messages can be "found" buried in a text. That type of mystical numerology, called *gematriya* by Hassidic Jewish scholars, is not at all what science is based on.

To make their way in science, or even to be thoughtful citizens in a science-based society, young people must learn to handle basic math. The stepping stones to science are arithmetic, algebra, geometry, trigonometry, and calculus.

It seems fair to say that God loves mathematics, since the world is created to function in a mathematically precise way. In fact, that's what enables scientists to discover "natural laws."

When Ann Hunt chose to follow a scientific career she knew relatively little about science and had no clear idea where such a commitment might take her.

The same could be said about her choice to follow Jesus. Ann's life has not been like driving down a freeway stretching for miles ahead so she could see exactly where she was going. In Psalms 119:105 the word of God is called a lamp to our feet and a light to our path. What the Lord promises to show us is not necesssarily the whole path, but our next step.

Hops, skips, and jumps

Much is said in the New Testament about "the Christian walk"—which sounds like moving steadily along, one step at a time. A few episodes in Ann Hunt's life were more like a hop, skip, or jump. At critical points, God seemed to guide her in rather direct ways. Her Christian life has often been closely intertwined with her professional life. One influence on both was her college roommate, a biology major who introduced Ann to Jesus Christ. Inter-Varsity Christian Fellowship put her in touch with other Christians, some of them in the sciences.

In the early 1970s, a Christian chemistry professor at LSU introduced Ann to the American Scientific Affiliation, a national fellowship of evangelical Christians in scientific work. In 1982 Ann Hunt became the first woman elected to ASA's Executive Council—and in 1986 its first woman president. At one ASA meeting, Ann met a Christian biologist from England doing postdoctoral work in the U.S. Through him she later learned of a research position open at Harvard, just when she needed it.

Presiding at the 1986 meeting of the American Scientific Affiliation.

In 1985 ASA held a joint conference at Oxford University with a British group called the Research Scientists Christian Fellowship. Ann was able to extend her Oxford trip to lecture at the Lilly Research Centre in Surrey and to attend a London meeting of the Society for Magnetic Resonance in Medicine.

Going the distance with God

Not all Christians speak freely about God's direct influence on their present lives. Yet life is a passing stream. We reflect on the past and anticipate the future, but we can function only in the present. The apostle Paul summed up the enduring qualities as faith, hope, and love (1 Corinthians 13:13). Faith can be thought of as the capacity to see God at work in the past, hope as the capacity to see God at work in the future, and love as the capacity to work with God in the present.

Ann Hunt can look back and see how God has led her, in small steps and major leaps. She has seen her work as a chemist facilitate the search for new medicines. Along the way she has represented Jesus Christ to students and to colleagues. She is able to integrate theological insights with her scientific outlook. Without trying to figure out what has been most important, she is willing to give God full credit. Ann is still on the path.

In all your ways acknowledge him,
and he will make straight your paths.

Proverbs 3:6

Ω

Thoughtful Worship

ONE STEP AT A TIME

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[3]*Dictionary of Scientific Biography*, editor-in-chief Charles Coulson Gillispie (New York: Charles Scribner's Sons, 1975), vol. XII, s.v. "Scheele, Carl Wilhelm."
[4]Plato, "Phaedo," in *The Collected Dialogues of Plato* (Princeton, NJ: Princeton University Press, 1961), p. 46.
[5]George L. Murphy, "The Paradox of Mediated Creation *Ex Nihilo*," *Perspectives on Science and Christian Faith 39* (December 1987), p. 221.
Scripture citations are from the Revised Standard Version.

George L. Murphy

St. Mark Lutheran Church
Tallmadge, Ohio

Seeking Ancient Paths

An American Association of Petroleum Geologists convention at Dallas offered my first chance to visit the famous dinosaur trackways and some alleged human footprints near Glen Rose, Texas on April 21, 1983. That month's *ASA Newsletter* led to a sparkling correspondence with Ronnie Hastings of Waxahachie. He and Glen Kuban invited me back in 1987 for a full two weeks in the Paluxy River valley. Beginning on August 21, our expedition covered the surviving documented sites along with some which had never been reported, local museums, and available sources of information. We investigated rumors of anomalous fossils, examined myriad clues to the ancient setting, and allowed the evidence to shape our conclusions.

The best "mantrack trails" already had been studied and shown to be plantigrade (metatarsal) trackways of bipedal dinosaurs, especially at McFall, Taylor and West sites (Godfrey and Cole, 1986; Hastings, 1985, 1986, 1987a&b, 1988; Kuban 1986a&b, 1987a&b, 1988). Supposed footprints on the Dinosaur Valley State Park ledge or shelf, including "eroded brontosaur," "bear" and assorted human examples (Morris, 1980, pp. 155–158; also cited by Wilder-Smith, Dougherty, and Baugh) were demonstrated to be erosional and weathering features (Milne and Schafersman, 1983; Cole and Godfrey, 1985; Godfrey and Cole, 1986; Hastings, 1988; Kuban, 1988). Similar features at other sites (cited by Dougherty, 1984, as human footprints and a dog track) had likewise been recognized as inorganic in origin, prior to our fieldwork. Even so, we reviewed each site and allegation, continued to map, measure, and photograph.

Tridactyl patterns indicating dinosaur toes (in some cases also claws) are visible in each theropod trackway of the plantigrade variety which has been considered a "giant mantrack trail" to correlate with Genesis 6:4. Though individual tracks may be indistinct, others in the sequence confirm their origin. Discolorations are evident in a Bible-Science Association poster, available at Somervell County Museum, of a Taylor Trail track photographed more than a decade ago (also in photographs in Dougherty, 1984 and Morris, 1980). Some of the Kuban/Hastings cores have been analyzed at Indiana/Purdue University, found to be more dolomitic within the toe outlines than outside the track (Farlow, 1987, pp. 26–27; as anticipated by Hastings, 1987a and 1988). This contrast in mineralogy extends to the substrate, ruling out any suggestion of tampering. I postulated (Hastings 1987a, p. 14) that such selective dolomitization may reflect greater concentrations of cyanobacteria in the pools which probably filled the footprints at ancient low tide: the bacteria inhibit limestone from forming, while their chlorophyll increases concentration of magnesium ions.

We checked fresh excavations at the McFall and Kerr Sites, where "mantrack" discoveries continued to be reported after the Taylor Site's recognition as dinosaurian. Tridactyl patterns exist in the 1987 trails, too. Some supposed footprints are also erosional marks, and the "bauanthropus" depressions which presumably represent places where a dinosaur appendage grazed the mud (Hastings, 1988). Again, there were no human prints.

Glen and I found the limestone undisturbed by excavations at the reported site for Clifford Burdick's "mantracks." I saw one of these and a "cat track" (Morris, 1980, pp. 2, 122) at Carl Baugh's Creation Evidences Museum: chisel or centre punch markings were visible, apart from obvious anatomical errors (Armstrong, 1987). Such forgeries are still used to solicit funds, and the books which present them as genuine (for example, Whitcomb and Morris, 1961; Dougherty, 1984) remain in print without any disclaimers or hints of doubt. A photograph on the cover of Carl Baugh's "Creation Evidences in Color" booklet, which I obtained from his museum, shows *Thalassinoides* (crustacean burrow casts) outlined in ink, as a human footprint.

The dinosaur trackways are spectacular, worthy of exploration apart from any search for non-existent "mantracks." Most have been attributed to *Brontosaurus* (properly, *Apatosaurus*) and *Tyrannosaurus* (in Morris, 1980; Dougherty, 1984), though neither genus is known from the Lower Cretaceous Comanchean Series of Texas. Sauropod trackways were most likely left by a small brachiosaurid known as *Astrodon* or *Pleurocoelus*. Theropod tracks, both digitigrade and plantigrade, could represent several genera but especially *Acrocanthosaurus*, alternately called allosaurid, megalosaurid or spinosaurid (Langston and Perkins, 1983; Farlow, 1987). A rare third type of track is thought to be from a bipedal ornithopod such as *Iguanodon*. About 500 dinosaur tracks are visible at the state park, and 120 at Taylor Site alone.

Glen Rose Formation is a sequence of limestones interbedded with marls and shales, rich in clues to the ancient environment: apparently a subtropical, arid tidal flat and estuary between 100 and 120 million years ago. Mud cracks indicate that the track-bearing strata used to dry out at low tide and probably for some longer durations. Algal mats in some beds represent hypersaline intertidal settings. Freshwater influx was suggested by our discovery of one *Viviparus* snail, in marl. The marls between track-bearing limestones are filled with fossils of mussels, oyster beds, burrowing clams, and snails; serpulid worm patch-reefs encasing carbonized brace roots from mangrove-like trees; spheroidal algae, or possibly sponges, called *Porocystis*. A thin storm deposit of small clam shells (the *Corbula* layer) overlies the main *Porocystis* and serpulid concentrations. Pycnodont fish teeth are found in both strata; the pycnodonts probably

nipped reefal organisms, crushing calcareous shells in beak-like jaws laden with teeth.

Most of the fossils are marine. Mud cracks, crustacean burrows, algal beds, serpulid patch-reefs, and oyster beds in growth position suggest longterm deposition, militate against flood geology interpretations. Storms, tides, and localized events account for the exceptional strata which were rapidly buried. Although John Morris reasoned that closed clam shells indicated sudden inundation (Morris, 1980, p. 151) these were burrowing clams already surrounded by mud. His reference to a conglomerate of rounded limestone pebbles, in the same paragraph, is surely a misreading of the *Porocystis* abundance. We traced rumored horse and deer footprints to partly exposed oyster beds and cross-sections of burrowing clams. Scallop shells and pholads (rock-boring pelecypods with delicate shells, called "angel wings") occurred at one outcrop.

Apart from false "mantracks" and the other items mentioned by Hastings (1988), Baugh's Creation Evidences Museum contains nodules misinterpreted as human and monkey skulls, dolomitic concentrations in weathered limestone as an "impacted snake fossil" and countless other oddities which mislead honest creationists. Calling the Moab skeleton Cretaceous (Hastings, 1988), when the formation it supposedly came from was really Jurassic, reminded me of the self-defeating advertising for a Glen Rose restaurant which listed sumptuous buffets, but said "better than that, come in for coffee with your friends and plan your day." Actually, the skeleton had been dated at a few hundred years (Hastings, 1985, 1986). Dinosaur bones excavated upriver, near the county line, are displayed (the ischium is labelled "femurs," and pubis is designated "ilium" in the coloring booklet). Baugh's 1987 discoveries, intended to collapse the geologic timescale, include a supposed Cambrian trilobite and allegedly human incisor: both were pycnodont or closely related fish teeth from the McFall Site, marine fossils normally found in the formation (Armstrong, 1987). The guide told me that they would have excavated the skull, too, but the landowner wouldn't let them; no bones could be found at the tooth site.

A "human hand print" at Baugh's museum turned out to be solution weathering markers, known as *karren*. A Y-shaped bone was called the forehead horn of a newly discovered dinosaur (*Unicornosaurus*) and correlated with the unicorn of Job 39:9 in the King James Version. The horn supposedly folded back like a jack-knife blade! I confirmed suspicions of the correct identification at my next salmon supper: this was a neural spine from a fish large enough for Jonah. Specimens labelled "dinosaur claws" were teeth from predatory fish.

My "downtime" following an eye injury on August 25 led to a speculative, intuitive hypothesis based on observations. Carnosaur tracks predominate the site, in contrast to the four percent of skeletons representing that type of dinosaur; plantigrade tracks are common; the area had been a tidal flat, and all the recently misinterpreted fossils came from fish: therefore, I suspect that carnosaurs probably stalked fish in tidal pools, crouching as they did. The "bauanthropus" marks might even be where prey had struggled. Glen had perceived the probability of crouching carnosaurs, and written more cautiously than my independent, visionary assessment (Kuban, 1986a&b).

The day before leaving Texas, I enjoyed a morning at Fossil Rim Wildlife Ranch, also near Glen Rose. The first African animal to beg for alfalfa concentrate through the car window was a single-horned addax, one of the most likely candidates for the unicorn! Sunday's closing hymn, back in Calgary, almost brought laughter because it referred to going "through the deep waters," so soon after I had waded up to waist-deep in the Paluxy. Later reflection led to correlation between what we did and Jeremiah 6:16—we had gone to the crossroad, sought ancient paths, and walked in them.

Although the allegedly human evidence was weighed and found wanting, like Belshazzar's reign (Daniel 5:27), the saga will continue because people are taught that the scenarios are proved in the Bible. They are welcome to their interpretation. However, unethical promotion methods and false accusations to the effect that opponents wrote without checking the evidence so carefully examined, together with confrontationism, are violations of the biblical commandments. All are practiced in the name of biblical adherence, Christian apologetics.

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John R. Armstrong

B1, 4515 Varsity Drive N.W.
Calgary, Alberta
Canada T3A 0Z8

Franklin, Deist

Benjamin Franklin (1706–1790) has been called the first American. He was certainly the outstanding American scientist of the eighteenth century, a New World physicist.

He was the fifteenth of seventeen children born in Boston to Josiah Franklin, an emigrant from Banbury, and Abiah Folger, an emigrant from Norwich. Intended initially for the Church, he was sent at eight to a grammar school (later the Boston Latin School), where he became the head of his class. He learned to read and enjoyed doing so the rest of his life; hence his many literary citations. Owing, however, to the cost, after one year he was sent to George Brownell's school for writing and arithmetic. He failed arithmetic, but mastered it later; nevertheless, it persisted as a weakness throughout his life. At ten he became a school dropout as he had to assist his father, who was a soap boiler and tallow-chandler. The remainder of his excellent education was self-taught.

Two years later Benjamin was indentured to his brother James, a printer. Ever after he regarded himself primarily as a printer. At eighty-two he began his Will, "I, Benjamin Franklin, printer"—noting only later his having been an ambassador. Despite the call of the siren sea (he was an adept swimmer) he devoted his private studies to journalism. He strove to imitate the clear, smooth short style of Joseph Addison in the "Spectator." At sixteen, his fourteen "Silence Dogood" letters were published in the *New England Courant*; these, some say, established the American style of literature. At seventeen he ran away from Boston. Today his statue stands in front of the old Boston City Hall, now a bank.

Franklin found employment as a journeyman with a printer, Samuel Keimer, in Philadelphia, a city of 10,000—then the second largest in the British Empire. He lived in the home of John Read on Market St. At nineteen he was sent on a mission to London by the Governor, William Keith, who left him stranded there without funds. He found employment as a printer, but did manage to meet some prominent scientists such as Henry Pemberton and Hans Sloane (to whom he sold a rare asbestos purse). He was able to return to Philadelphia the next year and renew his printing work, while assisting also in a store to pay for his return trip. About this time he outlined a life plan based upon frugality, industry, and truthfulness. He organized the Junto (a "Leather Apron Club"), which met every Friday at a tavern to discuss humane and practical questions.

At twenty-two he opened his own printing shop, which prospered for twenty years. The following year he purchased the *Pennsylvania Gazette* (later known as the *Saturday Evening Post*). At twenty-four, he became Public Printer for the Pennsylvania Assembly—followed later by those in Delaware, New Jersey, and Maryland. In that same year he married the faithful, stay-at-home Deborah Read. Two years later their son Francis was born, only to die at four. (Meanwhile, Franklin had had an illegitimate son, William Temple.) At twenty-five he organized a subscription Library Co. (When he died, his private library of 4,000 volumes was the largest in the country.) In 1732 he published the first "Poor Richard: an Almanack" (for 1773)—the one in 1748 sold 10,000 copies.

At twenty-seven, Franklin became Clerk of the Assembly. He organized the Union Fire Co. (nineteen years later he formed the first American Fire Insurance Co.). After four years he was appointed Postmaster of Philadelphia. At thirty-two he had a daughter, Sarah (she married Richard Bache). In 1743 he proposed a Society for Promoting Useful Knowledge, which was formed the next year as the American Philosophical Society with Franklin as its Secretary. The year before he retired from printing at forty-two, he organized an Association for Pennsylvania Defense. He was elected a member of the Philadelphia Common Council. In 1749 he was elected President of the Trustees of the Academy of Philadelphia, which he had proposed (it became the University of Pennsylvania). At forty-five he was a Philadelphia member of the Assembly and also an Alderman. Two years later he was made Deputy Postmaster General. At the Albany Congress the following year he proposed a plan for uniting the colonies. The next year he became President of the Managers of the Pennsylvania Hospital. He assisted Gen. Braddock with transportation problems, and later himself organized the Philadelphia Militia.

As a public man, at fifty-one he was a natural agent for the Assembly to send to London, presumably for six months, actually for six years—largely at his own expense. William Temple, who accompanied him, had an illegitimate son, but managed to marry a London beauty in 1761, the year of the coronation of George III. (The son later became Governor of New Jersey, but was reprimanded for disloyalty in his father's will.) At fifty-six, Franklin returned to Philadelphia (he built a new house). Two years later he was elected Speaker of the Assembly—only to lose out in his bid for re-election as a member. Accordingly, the Assembly sent him back to England as its agent—later the agent also for Georgia, New Jersey, and Massachusetts. At sixty-three, he was made President of the American Philosophical Society, renewed each year thereafter until his death. Two years later he wrote Part I of his "Autobiography" (Part II twelve years later, Part III seventeen years later—incomplete). Unfortunately, George III had no interest in trade or science—hence

not at all in Franklin. At sixty-eight, having sent copies of some state letters to Boston, he was arraigned before the Privy Council with regard to a Boston petition, which was rejected. Franklin was dismissed as Deputy Postmaster General and sent away in disgrace. After his wife died, at sixty-nine he returned home.

Franklin was elected Postmaster General by the Second Continental Congress; he was made a Pennsylvania Delegate to it. The year following he was a member of the committee to draft the Declaration of Independence and then a Pennsylvania Delegate to the Constitutional Convention. At seventy-two, he was one of three Commissioners sent to Paris and became Plenipotentiary Minister to the French Court the following year. At seventy-nine he returned and was elected a member of the Pennsylvania Supreme Council, then President for three years. The next year he enlarged his house. He organized a Society for Political Enquiries, of which he became President. He was also made President of the Pennsylvania Society for Promoting the Abolition of Slavery. (In his will, he freed his personal slave.) He was a Pennsylvania delegate to the Federal Constitution Convention, where he introduced the Great Compromise regarding representation. He gave the closing address. He died April 17, 1790, and was buried in Christ Church graveyard in Philadelphia. There was a cortege of 20,000 for this colonial patriot and American sage.

Throughout his life Franklin was prone to self-examination, resulting in integrity. He exercised methodical discipline and reasonable order. Exhibiting common sense, he was shrewd and pragmatic. He was sincere and honest, he showed personal benevolence. His goal was human freedom and dignity. He was amiable rather than aggressive, hesitant to offer an opinion that might offend. He had good humor and a ready wit. He made lasting friends of all ages. He was at home chatting before his fireplace or joking at the club. He enjoyed life, good food, rum, and Madeira; he did not smoke, chew, or use snuff. He was generally temperate, although while young he was addicted to low women and when old he was till quite fond of the fair sex. In his will he left two extant, philanthropic trusts: one to Boston and one to Philadelphia.

Franklin was an ingenious natural philosopher. He had a genuine curiosity about natural phenomena: the dew on the outside of a tankard, the quieting of disturbed water with oil, the heat absorbed by cloths of different colors. On his ocean voyages he noted atmospheric phenomena and was the first to measure the temperature of the Gulf Stream. In Maryland he rode after a whirlwind. He observed that the path of a northeast storm did not have the direction of the wind.

Although an amateur gifted in providing only qualitative explanations, he was truly a physicist—owing largely to his investigations of electrostatics. He did not begin experimenting until his retirement approached. Within four years from his start, at forty-one he published his "Experiments and Observations." He had learned how to electrify an electrical conductor permanently. He proposed a single electric fluid whose excess signified a positively charged body; its deficiency, a negatively charged one—an implication of conservation of electric charge. He was thus able to explain the behavior of the charged Leyden jar and to predict the discharge of a metallic point. He proposed an experiment to show that awful lightning was basically a large electric spark—verified first in Paris and shortly after in a modified way with his own kite experiment in Philadelphia. He was made Fellow of the Royal Society of London, several times a member of its council, the first foreigner to receive its coveted Copley medal. He was made a Corresponding Member of the French royal Académie des Sciences—the next American was Louis Agassiz a century later. He received honorary degrees from Harvard, Yale, William and Mary, Oxford, and St. Andrew's.

Franklin was a gadgeteer. Musically inclined (he played harp, guitar, and violin) he made a so-called "armonica" with rotating glass hemispheres of different diameters that sounded when touched. He made a flexible catheter for his ill brother, a mahogany chair with a ladder beneath its cowhide seat, a long arm to grasp books from a high shelf, and bifocal spectacles (Paris 1784)—not to mention his cast-iron stove, the Pennsylvania fireplace.

Franklin's religious ideas did not vary much from the "Articles of Belief and Religion" he formulated at twenty-two to the explanatory letter he wrote at eighty-four to the request from Ezra Stiles, Congregational clergyman, President of Yale. He was essentially a Deist—believing not in a disinterested God or a materially interested God or a God morally concerned about the present, but rather in an eternal God of reason, Creator of the Universe. God, of course, was governor of the world; He guides (steers) it. To do so, communication is requisite; i.e., prayers. Hence on 28 June 1787 Franklin moved that the Convention begin each day with prayer—not passed owing to the disbelief of three or four members. Franklin noted that the building of the Tower of Babel had failed because of the lack of God's help, which is requisite for men to cooperate—he cited Psalms 127:1.

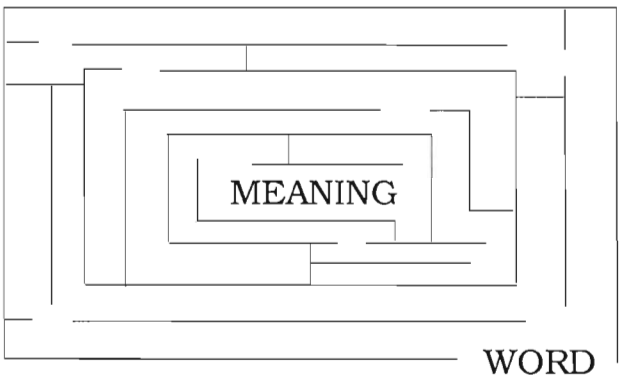
Franklin was not narrow in his religious outlook. When the evangelist George Whitefield visited Philadelphia in 1739 for the Great Awakening, the local clergy kept their church doors closed. The next year Franklin assisted in the erection of a new building accessible to a speaker of any religious persuasion. He himself contributed to the support of the Presbyterian Church and to Christ Church for a pew; the latter was attended by Deborah. In 1750, he assisted Sir Francis Dashwood prepare an abridgement of the Anglican Book of Common Prayer. In his letter to Stiles, he agreed that Jesus Christ had the best systems of morals and religion, but was inclined to accept the doubts of the Dissenters as to His divinity. He believed in an afterlife, but, in general, he had no interest in speculative philosophy, including theology.

Raymond J. Seeger

4507 Wetherill Road
Bethesda, MD 20816:9L

Twenty-fourth in a series by Raymond J. Seeger about scientists and their religion.

Penetrating the Word Maze



Taking a look at words we often use—and misuse. Please let us know whether these attempts at clarification are helpful to you.

Today's words are: "determinism/chance/free will."

The Dictionary definitions: ***determinism:*** *"a theory or doctrine that acts of the will, occurrences in nature, or social or psychological phenomena are causally determined by preceding events or natural laws."* ***chance:*** *"something that happens unpredictably without discernable human intention or observable cause."* ***free will:*** *"voluntary choice or decision; freedom of humans to make choices that are not determined by prior causes or by divine intervention."* [Webster's Ninth New Collegiate Dictionary, Merriam-Webster, Springfield, MA (1987)].

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Some scientific terms invite being extrapolated into general philosophical perspectives. Few terms are more susceptible to this kind of misuse than "determinism" and "chance."

They are a peculiar pair, for they seem to be a prime example of a philosophical Catch 22. Both kinds of scientific descriptions are essential to describe a whole human being able to act responsibly, while at the same time the use of either kind of description by itself makes it impossible to make such a description.

The dilemma sharpens with the realization that any scientific description must be either "deterministic" or "chance." If a process can be described in terms of exact mathematical relations, so that the future can be accurately predicted from a knowledge of the present, then you have a *deterministic* description. If a process cannot be so described, but must instead be described in terms only of the probability of various future outcomes resulting from present conditions,

This column is a regular feature of *Perspectives on Science and Christian Faith*, written by **Richard H. Bube**, Professor of Materials Science and Electrical Engineering at Stanford University, Stanford, California.

then you have a *chance* description. There isn't any other kind of scientific description. If you make a scientific description, it has to be of one type or the other.

Consider the following curious paradox. What kind of scientific description of a human being is indicative of the ability of the person to act responsibly with some measure of "free will"? A deterministic scientific description appears to contradict such free will—for how can what is determined be free? But at the same time, a deterministic scientific description is needed. How can a responsible choice exist without being describable in a cause and effect framework?

By contrast, a chance scientific description appears to make room for free will by removing the constraints of determinism; but how can a situation be considered to involve a responsible human choice if it corresponds to chance, a random and unpredictable action?

The situation is made worse when deterministic scientific descriptions are accepted as the basis for a world view of Determinism (note the capital "D") in which human beings are little more than genetic or environmental robots, or when chance scientific descriptions are believed to be the basis for a world view of Chance (note the capital "C") in which existence is intrinsically meaningless. If both Determinism and Chance do violence to the biblical view of the human being, and if only deterministic or chance descriptions are possible for science, how can we get out of this dilemma?

This is such an ancient philosophical conundrum that it would totally threaten my credibility if I claimed to be able to provide a neat and simple response to that question. But I think that the realization of the nature of the problem may well be the first step to avoiding the pitfalls of extreme positions.

An analogous paradox lies at the center of the biblical teaching on God's sovereignty and human responsibility. Is a person's coming to saving faith the inevitable consequence of God's determining election, or is a person's coming to faith an act of free human choice among equally possible alternatives? How do we respond to this paradox? Usually we realize that we must hold both perspectives in tension. We recognize that they address different questions in different contexts, and that it would be presumptuous to suppose that we could accurately express in our human concepts the profound realities of God and His creation. Perhaps this provides a clue as to how to respond to the scientific determinism/chance dilemma.

A resolution of this type is strengthened by two other realizations: (1) determinism and free will are not concepts that we can use in an absolute sense, and (2) we often find a complex interaction between deterministically describable processes in the same phenomena.

Although strict determinism may be postulated as a theoretical concept, the actual experience of such strict determinism is practically impossible in experimental science. In even the most completely deterministic, simple, physical system, we must constantly deal with statistical fluctuations beyond our control. On the other hand, it is equally true that no will is ever completely free, but is conditioned, shaped, and bounded by a variety of genetic and environmental influences.

In most major complex systems, there is an interaction between deterministic and chance effects. An individual event, like the decay of a radioactive atom, may be totally describable as a chance event; but the time for half of a large number of radioactive atoms to decay can be predicted deterministically. The position and velocity of atomic particles can be described only within a probabilistic (chance) framework, but the probability itself can be described deterministically. A scientific description may be totally deterministic in form, but its outcome is largely determined by particular "boundary conditions" that may well be the result of chance. A deterministically describable process can be the instrument of design (as in the specific configuration of hydrogen and oxygen atoms in the water molecule), but so can a process describable as chance (as in the creativity expressed in the multiplicity of human beings described scientifically through the chance assignment of DNA configurations).

So we come to the conclusion that questions dealing with determinism and chance must abandon the question for a general answer. Instead we must ask: To what extent am I influenced by deterministic processes, to what extent am I influenced by chance processes, and at the same time to what extent am I free to make responsible human choices?

What we know as scientific chance does not have any direct bearing on what we mean by free will. Nor does discovery of chance events in the world have any basis for being interpreted as meaningless. We must challenge any contention that deterministic and chance scientific descriptions lead directly to Deterministic and Chance world views.

Feel free to let the Editor or Author know whether you determined to read this column, or whether it was just a lucky chance.

Richard H. Bube

Stanford University
Stanford, California 94305

NEGLECT OF GEOLOGIC DATA: SEDIMENTARY STRATA COMPARED WITH YOUNG-EARTH CREATIONIST WRITINGS by Daniel E. Wonderly. Hatfield, PA: Interdisciplinary Biblical Research Institute, 1987. 130 pages, index. Paperback; $6.95.

Rarely is a book published which is *must* reading by advocates of both sides of a controversy, but Daniel Wonderly has produced a work which needs to be read by all who are engaged in the dispute concerning the age of the earth. Wonderly has provided considerable geologic evidence in the area of sedimentology to show that the earth cannot be only a few thousand years old as declared by young-earth creationists. He bases his conclusion upon well-established principles and sets of data which been verified by several research scientists over a period of at least a few years.

The main thesis of this work is that young-earth creationists have neglected or ignored an enormous quantity of evidence which argues in favor of an old earth. Wonderly is well qualified to discuss this evidence. He has devoted a major part of the past 15 years to the study of sedimentary geology through extensive and regular study of published reports of recent sedimentary research projects carried out by teams of petroleum geologists, oceanographers, and other earth scientists. He has also been an active member of the Geological Society of America and has had regular attendance at professional geological meetings and participation in field trips prepared and led by the society.

Wonderly divides his book into ten chapters. Except for chapters 5 and 10, he demonstrates in each one that young-earth authors have made major errors in their estimates of how and when the earth's sedimentary cover was formed. Many research reports of sedimentary geology are cited, with specific page numbers given, to show the reader which important characteristics of the sedimentary strata have been neglected by young-earth writers.

Beyond this citing of neglected data, Wonderly devotes a considerable amount of space to the nature of positive evidences for long periods of time. He does this by concentrating on four basic processes observed in sedimentary strata which argue very strongly for an old earth. The first one deals with ancient deposition, formation, and erosion of strata. Wonderly points out that different sedimentary strata show erosional factors at their point of contact which demonstrate that the lower layer must have lithified (turned to rock) before the upper layer was laid down. Contacts between layers show evidence of mud cracks, algal growth, scouring, and dissolution after lithification. One also finds animal bore holes and eroded shells of animals which were embedded in some rock layers (limestone in this case) before the formation of the upper layer. Since all the above characteristics take time to form, clearly they would be missing if these rock layers were laid down as a result of waves of sediment washing in over short time periods as a result of Noah's Flood.

A second process concerns the accumulation of great thicknesses of sedimentary rocks. Certain rocks take time to form because of the time it takes minute particles to settle to the bottom of a body of water and the time it takes for these particles to be lithified. For example, shales are formed by the compaction and lithification of microscopic particles of clay. These particles remain in suspension in water unless the water is completely still. Even then, the small size of the clay severely limits the speed at which it settles. Yet, two well-known areas in the western half of the U.S. display large quantities of shale in vertical sequences over broad regions. These shales took time to settle and lithify, so it is inconceivable that they formed in the short-lived, turbulent waters of the Flood. Nor could these shales have formed once the Flood waters subsided, for they are interbedded with other kinds of rock which form under different conditions.

The situation is even worse for limestone. Almost all limestone is produced biogenically rather than by inorganic precipitation, so the rate at which limestone is formed depends on the rate at which these living organisms can

secrete calcium carbonate or collect fragments of the same. Both the rates of calcium carbonate production and of lithification are rather slow; hence, a large amount of time is needed to form the thousands of vertical feet of limestone which are known to exist. In addition, former living structures such as algal mats and stromatolites are found in limestone, thereby emphasizing the time element for making this rock. There is conclusive evidence against the notion that present-day limestone was all dissolved in water and then precipitated during the Flood. Nor could it have been formed by the Flood's deposition of shells of formerly living creatures, for there would not have been enough creatures living at one time to produce the thousands of feet of limestone presently existing. Wonderly concludes by encouraging those who doubt the biogenic origin of limestone to visit their state's geologic survey office to see firsthand the samples of limestone which they have on display.

The cementation of rock is the third major physical process of sedimentary formations. Wonderly dispels the common, erroneous notion that rock is formed simply by the accumulation of many hundreds or thousands of feet of sediment which then turns to rock simultaneously throughout its entire vertical height. There are several evidences that this is not so: various layers of sediment would amalgamate rather than remain distinct, fossils in lower layers would be crushed by the sheer weight of the upper layers, and sediments would slide down slopes rather than maintain their grade. In short, a hardening process needs to occur to lithify lower strata before upper strata are added.

The hardening process is cementation, which is caused by the deposition of dissolved minerals between the solid particles which make up the rock. The minerals which serve as cement are calcite, silica, and iron oxide. These are dissolved in small amounts in the water which percolates through the sediments. When the chemical conditions are right, the minerals precipitate in the pore spaces between the particles comprising the rock. Eventually, the pore space is filled with cement and the particles stick together to form rock. In the case of limestone, careful estimates based on known physical processes indicate that 80,000 years are needed to form a 10 meter thick layer; yet there are layers of limestone which are thousands of feet thick. The conclusion that enormous periods of time are needed for these formations is inescapable.

The final process deals with ocean-floor and continental types of salt deposits called evaporites. These are specific kinds of deposits which occur in alternating layers, or couplets, of different minerals. These couplets can number in the tens of thousands, or even hundreds of thousands. They are formed as a result of the precipitation of mineral salts from concentrated sea water. As water in a basin evaporates and its mineral salt concentration increases, different kinds of minerals will precipitate sequentially out of the solution. The couplet nature of the deposits usually reflects a yearly pattern of wet weather in which minerals are washed into the sea, followed by dry weather which causes the brine to be concentrated so as to precipitate its dissolved minerals. In addition, many couplets include organic materials which come from the remains of algal growth in the brine during the time it is being concentrated. In fact, a fifteen-year study in the Red Sea shows present-day formation of couplets of algae and the mineral gypsum which match the form of many ancient deposits. Clearly, these kinds of evaporite deposits reflect a pattern which has been in operation for many years and cannot be explained at all by flood geology.

Many of these evaporites are of a special kind called "sabkha cycles." Present-day sabkha formations can be studied in the Persian Gulf, so their properties are well known. Wonderly ties together the information we have on sabkha cycles with what we know concerning the evaporite coverings of ancient, buried coral reefs. Specifically, over one-hundred well-formed atolls and other conical coral reefs have been found buried in the Rainbow subbasin of western Canada. These reefs developed practically all of the growth and erosional characteristics seen in present-day reefs and were later buried by sabkha cycles of evaporites. In addition, the reefs are undergirded as well as covered by thousands of feet of sedimentary rock which is known to have taken long periods of time to form, for some of this rock is composed of evaporites. In no way, therefore, are these formations the result of rapid deposition during the Flood.

Along with a positive presentation of evidence for an old earth, Wonderly dispels numerous explanations which attempt to explain sedimentary strata within a young-earth framework. He shows that rapidly forming beachrock is totally different from the main limestone formations of the earth's sedimentary cover. Beachrock, therefore, cannot be used as a paradigm for the formation of the large amounts of limestone prevalent in so many strata.

On another matter, Wonderly explains why all rock systems are not everywhere present (i.e., why there is not a continuous geologic column everywhere) by pointing out that various land surfaces on earth have been at different heights at various times, so different depositional and erosional processes have occurred in one area without these same processes occurring in all areas. Seeming distortions in the sequence of rock strata in the standard geologic column can be explained by faulting, folding, overturning, and uplifting.

Young-earth creationists argue that only rapid burial by Noah's Flood can explain the world-wide presence of fossils. Wonderly shows, however, that even though rapid deposition helps fossilization, a world-wide flood is not the only process which buries items to be fossilized. Turbidity currents (sediment laden, dense water currents) in the ocean can cover large areas with sediment, as can debris flows on land. In Wonderly's words:

> The belief that the majority of these deposits were formed by the Biblical Flood, which we recognize as being very recent, is especially untenable when we consider the mature state of most of the fossils found on the continents. Nearly all of these show not only the evidences for having been completely fossilized and encased in cemented sediment, but also the marks of having been further altered chemically and physically over long periods of time. In many formations we even find fossils which have been "reworked." That is, they are fragments which were eroded out of older strata and then incorporated into new rock layers. (p. 55)

Wonderly provides an excellent answer to the young-earth hypothesis of "ecological zoning" as an explanation for the distribution of separate kinds of fossils in the geologic record. Basically, this hypothesis states that the distribution of fossilized materials can be explained by the spacial distribution of flora and fauna which existed before the Flood. In this way, a world-wide flood would not jumble all the fossils together, for various kinds of flora and fauna would be buried at different times as the flood waters rose upon the land. Hence, the ecological zoning would be reflected in the distribution of different fossils in different strata.

Wonderly correctly rejects this hypothesis by showing that various kinds of fossils of numerous animals, which according to "zoning" should have occupied this same ecological niche, are found in entirely different strata. This holds true for large fossils like trilobites, brachiopods, and coral, and for very small fossils (microfossils) such as diatoms and radiolarians. These latter fossils have the added difficulty of settling out rapidly enough to form sediments in turbulent flood waters, not to mention the time it would take to cement as much as 20,000 feet of neatly layered sediment laden with these and other fossils. This was the same problem with the rapid formation of limestone. The conclusion is inescapable. The dissimilarity of fossils in differing strata occurs because the fossilized creatures existed at different times, not in different ecological niches.

Given all the above, one might wonder why young-earth creationists continue to support the concept of a young earth. Wonderly supplies five reasons: (1) Young-earth creationists have adopted a very narrow system of Bible interpretation that cannot include long periods of time. As such, field work is done to convince others of this view rather than to find and interpret what is seen. Also, young-earth creationists conclude that just because part of the geologic column can be explained by rapid deposition, then all of it can. (2) Young-earth creationists have been influenced by recent philosophical tendencies which contend that science cannot identify reality. Hence, in some circles, there is a distrust of science as it is presently practiced. (3) There is a lack of acquaintance with various branches of geology, especially in the area of limestone formation and appearance. This lack of information comes from (4) an isolation of young-earth scientists from others in the field. Finally, (5) only small packets of data are used to buttress preconceived notions while massive amounts of contrary data are disregarded. As a result, statements like that of Morris (that there is no type of geologic feature which cannot be explained in terms of rapid formation) are seen by those familiar with the field as dishonest, grossly ignorant, or irresponsible.

Throughout the book Wonderly displays a charitable attitude towards those with whom he disagrees, and this attitude contrasts sharply with the polemics all too prominent in the writings of many young-earth creationists. Wonderly lets the massive amount of evidence he accumulates sway the reader to his position. His wish, as well as mine, is that the young-earth movement cease its simplistic and outmoded assumptions, and begin to look seriously at the great mass of data which is available to show that the earth is old.

This book can be purchased from the Interdisciplinary Biblical Research Institute, Box 423, Hatfield, PA 19440. IBRI publications serve as a forum to stimulate discussion of topics relevant to the interaction of the Bible with various academic disciplines. The book is in a typewritten format, and it contains numerous diagrams and a glossary to help the reader understand the geological principles examined by the author. In spite of these helps, this work is not for novices. Beginners would do well to first read Wonderly's 1977 book which is aimed at the layperson (*God's Time-Records in Ancient Sediments*, Crystal Press Publishers, 1901 Proctor St., Flint, MI 48504).

PERRY G. PHILLIPS, Ph.D.

Associate Professor of Natural Sciences
Pinebrook Junior College
Coopersburg, PA 18036

Book Reviews

TRADITION AND AUTHORITY IN SCIENCE AND THEOLOGY by Alexander Thomson. Edinburgh, Scotland: Scottish Academic Press, 1987. 108 pages, bibliography, references. Hardcover; $16.95.

Tradition and Authority in Science and Theology is the fourth in the Theology and Science at the Frontiers of Knowledge series, edited by T.F. Torrance. It contains a foreword, preface, six chapters, and summary.

Subtitled "with reference to the thought of Michael Polanyi," much of the book is an appeal to Polanyi's thought. As both a biochemist and a theologian, Thomson should be well qualified to evaluate Polanyi's thinking and to write on science and theology.

Thomson begins by showing that science requires faith. Scientists believe that the world is meaningful and coherent. They also believe that the value judgments of the community of scientists reflect the best understanding of reality.

Thomson draws a very tight correspondence between the role of authority and tradition in the scientific community and the Reformed Church. The authority of science, according to Thomson, resides in its correlation with reality. The tradition is the handing on of the scientific mind by teaching and example from practitioner to student, generation after generation. Thus, scientists affirm an authoritative tradition in science.

The authority of theology also resides, Thomson argues, in its correlation with ultimate reality—with the eye witness accounts of the historical acts by which God has revealed himself, reported in the Bible. Furthermore, understanding these accounts requires the apostolic mind, just as understanding the natural world requires the scientific mind. The transmission of this apostolic mind is the role of the Church. "The Church exercises authority over the layman in the same way in which the scientific community exercises the authority of scientific opinion over the student."

Thomson devotes the remainder of the book to the differences in the Reformed and Roman Catholic views on both authority and tradition. He gives a brief but thorough review of the traditional views of both sides, and finally shows that the position based on Polanyi's philosophy of science guards against what he feels are the two false extremes: "Scripture Only," and Scripture and tradition taken as equal authorities.

Thomson is to be commended for this effort to provide a unified understanding of the created universe. He clearly shows many similarities between the scientific and theological approaches to reality. He would have done an even greater service if he had been more explicit about certain essential differences. In particular, as each person has only one lifetime to work out his salvation, there is an urgency and universality to religion that has no counterpart in science.

In his chapter on the role of tradition in science, Thomson should have provided more detail in his examples. It is difficult for a non-biologist to derive much benefit from his citations. Throughout the volume, also, Thomson uses the word "Church" in a confusing way. The reader assumes, initially, that it means the universal Church, and it is only about half-way through the text that the reader learns that Thomson means the Reformed Church. Finally, Thomson's frequently reiterated statement, "there is little progress in science in non-European or non-American countries where there is no scientific tradition," sounds presumptuous in light of the very significant discoveries from, for example, Japan.

Everyone who reads this small volume will be given food for thought and a reason to question any who argue that no correspondence exists between the scientific and theological approaches to reality. Nevertheless, the weaknesses listed above narrow the audience which will be enthusiastic about this book.

Reviewed by Elizabeth M. Hairfield, Professor of Chemistry, Mary Baldwin College, Staunton, VA 24401.

UNIVERSE: God, Science and the Human Person by Adam Ford. Mystic, CT: Twenty-Third Publications, 1987. 228 pages, index. Paperback; $9.95.

Are modern science and theology at war? Of course not, says Adam Ford. "Each offers insights into reality and it ought not to be surprising if, through dialogue, each tradition is found to enrich the other." Contrary to a popular misconception, science does not dispel deep wonder; rather, it provides new occasions for awe of a deeply religious sort.

Chaplain to St. Paul's Girls' School in London, Adam Ford is a priest whose avid personal interest in astronomy and other

sciences comes to scintillating expression in this book. In a style that is at once articulate and artful, Ford deals with several profound questions that arise whenever 20th-century Christians strive honestly to incorporate the results of modern science into their theological vision: Does modern cosmology provide Christians with a new "story of creation?" Can God be seen in the phenomena described by scientific laws? What are the theological implications of the scientific theory of evolution? Can chance or accident play a purposive role in creation? Does it make sense to speak of the human mind as an "emergent quality of chemistry?" Why do natural catastrophes occur in God's good creation? What is the essence of miracles? Can Christian faith be falsified by science?

Not only does Ford grapple with difficult questions, but he also displays a willingness to challenge the adequacy of traditional vocabulary and concepts in the search for answers. Reductionism, deism, literalism, creationism and interventionism are all measured against the standard of biblical theism, and found wanting. The occasional "god-of-the-gaps" is soundly rejected in favor of a biblical vision of the sovereign Creator whose moment-by-moment activity is essential.

Ford maintains a high respect for the God-inspired message of the Bible, but expresses it in a language that may appear provocative to some readers. His readiness for employing the concept of "myth," for example, and his resistance toward depending on the Bible for data on historical particulars may put some conservative evangelicals at a distance.

The questions that Ford deals with are contemporary questions that *must* be addressed. This stimulating book deserves to be widely read. Suggestions for further reading and questions for reflection and discussion are conveniently listed at the end of the book.

Reviewed by Howard J. Van Till, Professor of Physics, Calvin College, Grand Rapids, MI 49506.

THE TREE OF KNOWLEDGE: The Biological Roots of Human Understanding by Humberto R. Maturana and Francisco J. Varela. Boston, MA: Shambhala Publications, Inc., 1987. 263 pages, glossary, index. Hardcover; $24.95.

The authors of this attractive book are Harvard-trained biologists specializing in nerve physiology, according to the blurb. The book is an outgrowth of lectures given by them jointly in 1980–81 in Chile. It was originally distributed as an internal report of the Organization of American States. It has since been beautifully illustrated, published in Spanish, and finally translated into English, apparently by the authors. Maturana has been exploring the interaction of biology and theories of communication as the basis of cognition since about 1960. Varela, originally Maturana's student, has been a collaborator since about 1970. Their early papers on the subject have appeared in English in *Autopoiesis and Cognition: The Realization of the Living* by H. Maturana and F. Varela (Boston: D. Reidel, 1980). They are clearly qualified to be given a hearing on the topic that they address.

The authors introduce themselves in the preface, from which most of the above information was taken, and then get down to making their case, which is not easily summarized. In the broadest terms, they regard epistemology (a term they do not use) as a branch of biology, and then treat it so. In light of the publication of Jean Piaget's *Introduction à L'épistémologie Génétique* in 1950 as the climax of about thirty years' working out of a similar idea that has at last begun to attract the attention of philosophers (e.g., R.F. Kitchener, *Piaget's Theory of Knowledge: Genetic Epistemology and Scientific Reason*, New Haven and London: Yale University Press, 1986), Maturana and Varela's view cannot claim to be altogether new. The authors' way of expressing it owes little to Piaget, who does not appear in the index, though it is not altogether different from that of his *Biology and Knowledge: An Essay on the Relations Between Organic Regulations and Cognitive Processes* (Chicago: University of Chicago Press, 1971). As Piaget said there: " . . . they are hypotheses which must be constantly and more extensively explored, because, strangely, specialists in epistemology, particularly mathematical epistemology, are too much inclined to leave biology out of account, while biologists, as a rule, completely forget to ask why mathematics is adapted to physical reality." True to form, biologists Maturana and Varela do not mention mathematics, even when discussing the normal functions of the brain hemispheres, leaving that epistemological conundrum implicitly included in their chapter called "Linguistic Domains and Human Consciousness."

The astonishing departure of the authors of this book is their contention that epistemology *matters*. In their last chapter, they point out that eating the fruit of the tree of the knowledge of good and evil transformed Adam and Eve into different beings. In their former nakedness they merely knew; "afterward, they knew that they were naked; then knew that they knew" (pp. 244f.). Only a poetic image, this reference is intended to be a new low in biblical interpretation. This book is intended as a popular "scientific study of cognition as a biological phenomenon" (p. 245). They offer, on the basis of their story, certain conclusions that most would regard as philosophical: certainty is a temptation and no proof, conflict must give way to coexistence, love helps us bring forth the world that we bring forth with others. "We affirm that at the core of all the troubles we face today is our very ignorance of knowing" (p. 248). We are the prisoners of our epistemologies.

The above conclusions are reached by a circular road that is spelled out in advance, in all its circularity, on page fourteen. The trip begins with some consideration of our ordinary experience, which is of course the basis of biology. Four chapters are devoted to an evolutionary treatment of molecules, single-cell organisms, and the succession of higher and more interesting plants and animals. The authors make some attempt to modify the notion of evolution with which they assume a reader begins, but attempt "no unified picture of how the evolution of living beings occurs in all its aspects" (p. 115). The next four chapters discuss behavior, starting with

the nervous system of a frog and working up through cognition in animals, persons, and societies to linguistic behavior. They contain an attack on the input-output computer model of the mind (p. 169) and the information-theory model of human communication (p. 196). The authors claim that the self arises with linguistic behavior. In the last chapter, they come to the conclusions that I have already sketched.

The book under review is intended to invite a reader to reflect on knowledge, but knowledge as an aspect of behavior, recognizing that all decisions are ethical decisions. As an invitation it probably works, but it does not go very far, and it makes no suggestions for further taking up the invitation. While much of the book's content will be known to biologists, other ASA members may benefit from reading this invitation, and even biologists may find the approach stimulating. This is a book not to be ignored; I have already ordered a copy to give away. Connections with issues of faith, however, will have to be supplied by the reader, as they are totally lacking in the text.

Reviewed by Robert Thomas, Professor of Applied Mathematics, St. John's College, University of Manitoba, Winnepeg, Manitoba, Canada R3T 2N2.

OUR SCIENCES RULED BY HUMAN PREJUDICE: Humanly Necessary Causal Blindness Persisting Even in Sciences by D.G. Garan. New York: Philosophical Library, 1987. 420 + xi pages, index. Hardcover; $29.95.

According to this book's dustjacket, the author "is well qualified to write on the unusual problems that the book explains and that require a scientifically precise yet very unorthodox approach." These alleged qualifications consist of three European doctoral degrees, four books "on scientifically revolutionary aspects of value relativity," an inclusion in *Who's Who in the World*, and the vague claim that "his work has been recognized as noteworthy."

This book presents a bizarre, vague quasi-theory of human thought and behavior called "relative or negative (opposite) value causality." Garan seeks to deploy this against accepted causal explanatory methodology in fields ranging all the way from psychiatry, psychology, and the social sciences to literature, philosophy, medicine, and theoretical physics. The idea of "relative or negative (opposite) value causality" goes like this: Human "inner values" causally derive from their "opposites" and causally determine human behavior, feelings, actions, lives, and even our thinking and knowledge of the world. The causal derivation of values from their opposites means that satisfaction of needs are commensurate with those needs. Thus, restrictions of satisfaction are actually good for us, since the corresponding positive values are increased with every additional restriction.

Because human beings function, indeed are determined, by this relative, negative, opposite-value causality principle (so Garan claims), this is the appropriate logic for the "human" sciences, though those in these fields (wrongly) use the normal, positive causality appropriate only in the "technical, exact" sciences. However, opposite-value causality is at the same time "impossible" in the sense that "men could not survive with relativistic value attitudes" (p. viii). Thus, such causality is repugnant to human thinking, even in science.

Unfortunately, Garan has worded his thesis incorrectly. First, a fundamental notion in his basic thesis is unclear: what should count as the negative "opposite" of a given positive value is far from obvious in many cases. Second, he claims that positive values diminish as their opposites are satisfied. Yet, this just is not the case. Consider the simple example of the satisfaction of eating, one of Garan's favorite examples of a positive value: 1.) eating becomes no less a positive value for me when I am full than when I am hungry (I don't cease to care about not starving just because I am full after a good meal), and 2.) I can still enjoy the taste of fine food or beverage even when full. These two facts show that there are at least *two* senses in which the value of eating does not diminish even when it is satisfied (when I am full). So, in contrast to Garan, increasing a negative value does not automatically decrease its "opposite" positive value. What Garan should have said is that as needs are fulfilled, the *current* value of the desire to have them satisfied decreases. This is virtually tautological. Yet Garan has made this molehill into a mountain; because of his faulty wording of the thesis, he was misled into thinking there was more here than really exists.

Garan argues for abortion and infanticide in the case of individuals of low intelligence. He claims that allowing them to live is a great inhumanity since they and those who care for them would undergo so much suffering and humiliation in life. But how is the minimal level (for permitting survival) of intelligence or other fitness parameters for fetuses and infants, both in general and in particular cases, to be decided, and who will make such determinations? Isn't it quite possible that some who get singled out for extermination might be misidentified; i.e., they might have turned out to be highly intelligent and perhaps capable of discovering a cure for a certain kind of cancer? As for the claim that permitting fetuses and infants of low intelligence to live is degrading and inhumane, Christians believe that all human life is sacred because each of us, even the most mentally or physically handicapped, has been endowed with the image of God. Further, such individuals have, in many cases, brought untold value into the lives of those entrusted with their care.

Garan even attempts to do theoretical physics, though he evidences no familiarity whatsoever with higher mathematics and explicitly rejects such fundamental concepts as the relativity of motion, the curvature of space, and the need for non-Euclidean geometry. He seeks to explain all phenomena discovered or posited by physics from at least Newton to the present in terms of a "Field" of force, which he also describes as "nothingness." He admits that no scientific instrument could ever discover this omnipresent force field since the field itself causally determines their functioning, as it does for everything else in the entire universe, from the movement of stars and planets to the minutest quantum fluctuations of electrons. Thus, because Garan's "Field" is undetectable *in*

principle, it can only be inferred by the intuition, *which Garan claims only he has ever had*, that whatever exists must exist in virtue of its causal "opposite." For in the case of "matter," which Garan seems to equate with mass, its causal opposite is the universal field (or so Garan claims).

Garan's "Field" amounts to a *deus ex machina*. Garan has merely attempted to identify (by postulation) the "hidden variables" that Einstein and his followers believed *must* lie behind the mysterious causal paradoxes of current quantum theory (though of course he never puts it in these terms). While deploring "metaphysical" explanations in physics, Garan is blind to the fact that his own "Field" is more metaphysically speculative than most metaphysical positions he attacks.

Proposing a radical new way of thinking about causality in science requires, minimally, a philosophical-scientific discussion of the theory of causal or scientific explanation as groundwork. Unfortunately, the author never supplies this. Instead, we are offered only endless, vague, rambling restatements of the main thesis. There is no critical interaction with current philosophy, including philosophy of science. The author seems quite out of touch with recent developments in these fields. This is not a book to be taken seriously.

Reviewed by Timothy A. Deibler, Ph.D. candidate, Department of Philosophy, Rice University, Houston, TX 77251.

THE MEDIA LAB: Inventing the Future at MIT by Steward Brand. New York: Viking Penguin, 1987. 285 pages, bibliography, photos, index. $20.00.

Steward Brand began publishing the *Whole Earth Catalog* in 1968, but by a half-dozen versions later, culminating in the *Whole Earth Software Catalog* in 1985, he had lost his "clear feeling of the 'future.' " What better place to find the future than at the Massachusetts Institute of Technology—a name synonymous with the leading edge of technology?

In January 1986, Brand became a part of MIT's Media Lab for three months. His brief stint resulted in the first half of this book, which is "the kind of in-depth tour of the Lab's researches that Lab people wish they could give every visitor" (p. xiii). The Media Lab is at the heart of a vast network of communication technologies which allow us to see how the Lab is "inventing the future." Some current projects include: a computer that can accompany a violinist, varying the tempo as needed; the "Vivarium" where life can be "created" by children and then continue to evolve inside a computer; and computers which schedule their owner's life, right down to a dinner date, through interaction with other computers. The second half of the book exposes us to the "media lab" of the world. We glimpse, at least in part, the future, and are charged to be aware of it, if not to do something about it.

Like Douglas Hofstadter's *Gödel, Escher, Bach*, the overwhelming picture is of the interconnectivity of things. Technology is converging, according to the vision of the Lab's director, Nicholas Negroponte, as the three distinct industries of broadcasting, publishing, and computing come together. As we are given an image of the world's industries merging, we find that the people of the world are also coming together. We see computer power, like electricity, as a grid with a life of its own where one can plug into an "outlet" and be united with the world—a world that could come from one of the most recent "cyberpunk" science fiction novels.

Halfway through the book, I was seeing another major turn in history similar to the Renaissance. But here, mankind is not the center of attention. Instead it is the individual experiencing a "personal renaissance." We find a new society where all the teeming pieces of information are carefully shaped to fit the individual. No longer does one have to read, watch, or even be exposed to unwanted information. The key word here is "broad-catch." It is the opposite of the terms broadcast and narrowcast that we find today, in that it is a method of

Books Received and Available for Review

(Please contact the book review editor if you would like to review one of these books.)

N. Angier, *Natural Obsessions: The Search for the Oncogene*, Houghton Mifflin

G. Bateson & M. Bateson, *Angels Fear: Towards an Epistemology of the Sacred*, Macmillan

D. Carlson, *Counseling and Self-Esteem*, Word

S. Cleave, W. Byrd & K. Revell, *Counseling for Substance Abuse and Addiction*, Word

J. Durant (ed.), *Darwinism and Divinity*, Blackwell

R. Eisler, *The Chalice and the Blade: Our History, Our Future*, Harper and Row

R. Frey, *Rights, Killing and Suffering: Moral Vegetarianism and Applied Ethics*, Blackwell

W. Granberg-Michaelson, *Ecology and Life*, Word

T. Glick (ed.), *The Comparative Reception of Darwinism*, Chicago University Press

H. House (ed.), *Restoring the Constitution (1787–1987): Essays in Celebration of the Constitution*, Probe Books

J. Kasun, *The War Against Population: The Economics and Ideology of Population Control*, Ignatius

D. Kliewer, *Managing Sexual Feeling in the Christian Community*, Link Care

J. Kristeva, *In the Beginning Was Love: Psychoanalysis and Faith*, Columbia University Press

G. Lewy, *Peace and Revolution: The Moral Crisis of American Pacifism*, Eerdmans

E. McMullin (ed.), *Construction and Constraint: The Shaping of Scientific Rationality*, Notre Dame Press

J. Martino, *A Fighting Chance: The Moral Use of Nuclear Weapons*, Ignatius

N. Maxwell, *From Knowledge to Wisdom: A Revolution in the Aims and Methods of Science*, Blackwell

G. Mooney & A. McGuire (eds.), *Medical Ethics and Economics in Health Care*, Oxford University Press

A. Peshkin, *God's Choice: The Total World of a Fundamentalist Christian School*, University of Chicago Press

G. Rekers, *Counseling Families*, Word

L. Richard, *Is There a Christian Ethic?* Paulist Press

F. Smith, *The God Question: A Catholic Approach*, Paulist Press

B. Spring & Ed Larson, *Euthanasia: Spiritual, Medical and Legal Issues in Terminal Health Care*, Multnomah

C. Thomas, *The Death of Ethics in America*, Word

content-specific selection. The daily news is culled by computer to deliver only advertisements and articles that it knows the individual is interested in. We find Negroponte's goal of "ultra-personalized intimate technology—everything made to order" (pp. 262–263) quite feasible. Brand forecasts that the computer will become as innocuous in our lives as the mechanical motor is today. Brand carries the reader on through this incredible world, but not without a few words of caution.

Brand explains in the beginning that the tendency to "boggle" in reference to the Lab's bag of tricks is normal. Information and communication technology are far outracing any attempts, especially political, to assimilate them into our present culture. Brand also talks of "communication ecologists." It sounds funny at first, as it is meant to be, but it does make sense. We need someone to be concerned for the health of our information network, I find myself thankful for the "tribal" cultures who will keep on going if this great global network, or "world city," crashes.

This is but a glimpse of what Brand provides in an entertaining and highly readable book that has much to offer to the scientific layman. He presupposes no particular background other than an interest in where this world is going and what one of the primary helmsmen, MIT's Media Lab, is up to. As Christians, we should be concerned with the future of the world as directed by science so we are not left standing with our mouths open.

Reviewed by Jennifer Joy, Wellesley College student, Wellesley, MA 02181.

CONTEMPORARY MORAL CONTROVERSIES IN TECHNOLOGY by A. Pablo Iannone. New York: Oxford University Press, 1987. 336 pages. Paperback; $12.95.

This book could be a discussion starter for a philosophy class. Indeed, Iannone is Associate Professor of Philosophy at Central Connecticut State University. The author has collected thirty-three essays or reports, and presents them here with opening comments. The book is divided into three sections: introduction, moral controversies discussed, and approaches to governing technology. There is a very concise glossary for the beginner and a handy selected bibliography.

The main purpose is clearly stated by the author several times: "To develop the ability to think well about moral matters takes a great deal of practice and reflection. This book is meant to provide conditions conducive to such practice and reflections." The entire book from introduction to bibliography is geared toward this goal. The prechapter summaries are accurate overviews of the articles' main points. The summaries also pose valid questions for the reader's consideration. The author has not moved away from the difficult problems of our day, and for this I congratulate him.

Unfortunately, in attempting to be neutral the author leaves the reader alone without a framework, or worse, without a guide. It is, however, only an attempt to be neutral, since the author does make value judgments. For example, in discussing an article on risk-cost-benefits the author refers to a conclusion as "absurd." This implies some presupposed universal standard, but he does not give the basis for this standard.

Reviewed by Bruce Bader, Senior Process Engineer, Aristech Chemical Corp., Florence, KY 41042.

THE RED APE: Orang-utans and Human Origins by Jeffrey H. Schwartz. Boston: Houghton Mifflin Company, 1987. 306 pages, illustrations, index, selected bibliography. Hardcover; $18.95.

It is widely accepted that the African apes are the living animals most closely related to humans, a belief held strongly enough to affect a range of other interpretations. But Jeffrey Schwartz asks whether there really is ample evidence to support this. Could it be that the orang-utan is more closely related to humans than either the chimpanzee or the gorilla?

The Red Ape is Schwartz's most accessible attempt to answer this question. Schwartz is associate professor of anthropology at the University of Pittsburgh. His previous publications on the topic include articles in *Nature*, *Current Anthropology*, and *Primates*. Here he applies a broad background in primate morphology to what might seem a rather narrow question. Given the details involved, 306 pages of sustained argument on just this question could easily become tedious. But that is not the case here. Schwartz uses many types of information, and by intertwining the exposition with a description of his trail of discovery, manages to convey some of his own enthusiasm for the field. He makes an effort not to avoid technical terms, but to make them understandable. Thus, the book makes greater demands on the reader than would a basic popular presentation, but compensates with better preparation for pursuing the subject further.

A description of the orang-utan is followed by a chapter on fossils. Both subjects are presented partly in the form of an intellectual history; the review of fossils in particular is not a summary of the evidence for human ancestry but a history of the search for human ancestors. Schwartz wants to know why we hold our views on human origins, and since ideas may have their own histories, this is not always purely a matter of basic data.

This perspective comes even more to the front when he covers the search for our closest relatives. It is a historical review of ideas on the place of humans in nature, from those of Thomas Huxley (whom he describes, with gentle understatement, as a "young, self-assured anatomist"), establishing the very idea that we have a place among the *other* animals, to specific ideas on what that place is. When discussing how one determines such relationships, he points out that classification is not merely a matter of discovery, it involves one's

purposes. The question of who is related to whom is much more complex than it may seem. It is a question of ancestry, an evolutionary question, and is not the same as asking what living animal is most similar to humans.

In three chapters on morphology, he moves from primates generally, towards smaller groupings. The larger hominoids (the chimp, gorilla, orang, and human) are distinct. There are also traits shared only by humans and orang-utans. Interestingly, these are shared by all other *Homo* species, *Australopithecus*, and *Sivapithecus* as well. This is followed by two chapters on molecular studies. These have tended not to support Schwartz' theory, and his approach is to emphasize their inconclusiveness.

Schwartz is continually asking how we know, and does not let answers go unexamined. But it should be clear that however deep his skepticism, it is not human evolution that he is questioning.

> Perhaps the largest flaw in systematic studies is the lack of unanimity—even a truly common language—on the most basic of theoretical and methodological principles. We might all agree that evolution "exists," and that it is the cause of the diversity of life on earth as we know it. We might even come to some general agreement on the major subgroupings of life forms, and, perhaps, even on smaller and smaller segments of these larger groups. But congenial communication eventually breaks down. (p. 291)

Beginning with none other than Alfred Russel Wallace, there have been many who are willing to accept evolution in general, but who balk at applying the idea to humans. While this issue is not part of Schwartz' probings, this book is of value to those of us interested in the matter—regardless of whether we are inclined to agree or disagree—for he clearly presents what is involved in the claim that two organisms are related, not just similar. It is important also to recognize the extent of the evidence, including the fact that fossils do not by any means exhaust the range of data bearing on the physical question.

There is no denying that as animals go, there is much similarity between the chimpanzee and the human. But is it greater than that between the organ-utan and the human? And is it the sort that evidences a recent common ancestor? Judging by the response to his other work, I would not expect an immediate turnabout in opinion on this matter. But an argument with this much substance to it is not easily dismissed, either. Schwartz' own conclusion is judiciously lacking in finality: "More than ever do I think there is something viable about the theory that humans and orang-utans are closely related. And that is because at present . . . I am not convinced that alternative theories of hominoid relationships are more robust" (p. 283).

This book is of value to those interested in the question of human-ape relatedness, and to anyone wishing to evaluate studies concerning the place of humans in nature. The dust jacket says it "provides essential reading in order to understand the underpinnings of 'modern' approaches to evolution. . . . " I do believe that, for many, this aspect of the book is quite as important as Schwartz' intriguing theory. And while perhaps not essential, it is a convenient and stimulating means to this end.

Reviewed by Paul K. Wason, Louisville, KY 40214.

SCIENCE AND EARTH HISTORY: The Evolution/ Creation Controversy by Arthur N. Strahler. Buffalo: Prometheus Books, 1987. 552 pages, index. Hardcover; $39.95.

The complex issues hidden under the paired shibboleths, "creation" and "evolution," have divided churches for decades; confronted pluralistic democracies with political lobbying and court cases; generated mutual misunderstandings and condemnations in debates, media presentations and an immense literature. Biblical interpretations, philosophy, and historical sciences are central, yet other disciplines are involved, so that a comprehensive study provided an exceptional challenge. Arthur N. Strahler, retired professor and former Chairman of the Geology Department at Columbia University, author of textbooks for thirty-seven years, accepted the task in 1981. His wide-ranging research, carefully updated and checked with various colleagues, yielded the most useful reference on these contentious topics. Despite the depth of explored arguments, his style is remarkably readable, so that a great deal may be learned by laypeople as well as by specialists. He criticizes each side, wherever distortions or arrogance have arisen; he gives due credit, too. He retains a sense of humor, lacking in many authors caught up in the controversy. His quotations are given proper context—a welcome contrast to the common pattern—regardless of sources. Scrupulous avoidance of *ad hominem* accusations brings a charming gentleness, all too rarely encountered amid the bitterly opposed factions whose works he puts in perspective. Neither creationist nor humanist, Strahler has a mission here to be heeded by all sides, "primarily to explain what natural science is all about and how scientists are doing it" (p. vii).

Some readers may be put off by artist Lois Darling's fine drawing of Darwin's venerable, benign-looking head, under Michelangelo's Sistine Chapel portrait of God (remarkably similar in features) on the tan-colored cover. I enjoyed the ironic picture, together with the other 300 illustrations.

Oversize pages accommodate two compact columns with about 1000 words per page, as in scientific journals. The book is divided into nine parts, comprising 54 chapters, followed by a brief "Summation and Verdict—Creation Science Assessed." Abbreviated and expanded tables of contents, extensive bibliography, and an index allow quick access to references.

Part I (Science and Pseudoscience) covers the philosophy and scope of science, and criticises the scenarios of Velikovsky and others. *Research fields* are distinguished from *belief fields*, according to Mario Bunge's criteria (Bunge, 1984, "What is Pseudoscience?", *Skeptical Inquirer*, vol. 9, no. 1,

pp. 36–46). This dichotomy does not imply rivalry, but reflects independence. If theology is implied to be pseudo-science, as apparently suggested, I must disagree, having studied and appreciated theology. However, the separation from science is reflected in the different use of terms (for example, "transgression" is wrongdoing in theology, whereas it means sea level rise in geology). This useful distinction is well-expressed by Rabbi Abraham Joshua Heschel (*God in Search of Man: A Philosophy of Judaism*, 1955) on the "basic difference in meaning, intention and theme between a scientific theory of the origin of the universe and what the first chapters of the Book of Genesis are trying to convey" (pp. 15–16).

Part II (Creationism—Its Roots and Tenets) refers to the "creation science" movement within fundamentalism, rather than the whole gamut of theistic interpretations. According to this usage, with which I concur, most biblical believers are not creationists. Parts III to VI contrast two views of: cosmology and astronomy, geology and crustal history, origins of landscapes, stratigraphy and the fossil record. Part VII covers "Integrity of the Evolutionary Record Under Attack by Creationists," Part VIII "The Rise of Man and Emergence of the Human Mind," and Part XI "The Origin of Life on Earth—Naturalistic or Creationistic?" Every aspect is meticulously explained, argued patiently and without spite. Moderate alternatives are expressed (day-age, gap theory, progressive creation, apparent age, and theistic evolution). Jesuit scholar James Skehan is quoted, together with the Church of England's Archbishop John Habgood of York, who addressed Wycliffe College alumni on "Evolution and the Doctrine of Creation."

Developments as recent as the June 19, 1987 U.S. Supreme Court decision regarding the Louisiana "balanced treatment" legislation have been included. Early history of geological theories may deserve more coverage to show how long ago some creationist explanations began.

Anyone seeking to understand this controversy will find treasure in *Science and Earth History: The Evolution/Creation Controversy*. Many may disagree with more statements than I do, but still recognize the excellence in this book.

Reviewed by John R. Armstrong, Honorary Assistant in Deacon's Orders, St. Phillip the Evangelist Anglican Church, Calgary, Canada.

TO GOVERN EVOLUTION: Further Adventures of the Political Animal by Walter Truett Anderson. New York: Harcourt Brace Jovanovich, 1987. 376 pages. Hardcover; $22.95.

A political scientist by profession, the author crusades for a "global bio-political culture" based upon an existential philosophy of secular humanism. Professional life scientists and theologians will find his dismissal, in the first two chapters, of Darwinian evolution and theistic religion, as amusingly naive as his enthusiastic confidence in human intelligence to control biological evolution, and to fabricate a sociobiological religion that endorses technological progress in the name of "global ecological and evolutionary governance."

The next three chapters are reminiscent of Herman Muller's impassioned plea to match the escalation of new knowledge in genetics with its application to genetic engineering and population control. Beginning with dire predictions of massive human-induced extinctions of species and lamenting genetic degeneration and loss of genetic diversity of domestic stocks, the author suggests an inevitable need for man to intervene in evolution while "... we do not have well-established institutional practices for using the information we have. ... "

The last four chapters, comprising roughly three-quarters of the text, are the author's agenda for establishing the political machinery that will "govern evolution," including the private lives of citizens of a world government, which functions as "facilitator and provider of information," while "... the locus of decision-making is at the individual level" and "new issues of biopolitics erode the old boundary between public and private life." Anderson's last point is for "shifting from description to prescription." One may wonder what effect this will have on decision-making on the individual level. With no boundary between public and private life, what practical effect does private decision-making have?

Even a superficial reading of the book reveals the author's lack of sympathy with theistic religion as a guiding light in human destiny. Anecdotal disinformation abounds, such as the Roman Catholic Church's teaching that animals have no souls, that a horde of locusts was excommunicated for destroying crops, that in the "myths of Genesis knowledge is equated with sin and punishment," and that "organized religions ... have made impressive efforts ... to ... prevent others from searching for new knowledge ... but with little success."

Anderson's new secular religion is identified with Turgot's philosophy as the "first manifesto of the modern religion of progress." Reverend Malthus is one of its "priests of progress." All supernatural references are omitted or misrepresented. Theistic religions, on the contrary, are invited to evolve into a naturalistic mode beginning with a new view of the natural world (an "eco-theology," supposedly derived from Oriental and Amerind cultures) with the expectation that the churches will change in the process. "Environmentalism" is identified as a religious movement "more successful than the churches at getting religious issues into the mainstream of public dialogue," and touted as an example of how well religion and politics mix. Like other "melting pot" strategies, however, this one would destroy the identity of one ingredient (theistic religion) and cook up a batch of eco-politics. Paul Ehrlich's "population bomb," and Garrett Hardin's "tragedy of the commons" and "lifeboat ethic" dogmas, would replace theistic guidelines. Anderson's fatuous attempt to link Francis of Assisi, patron saint of ecologists, and Pierre Teilhard, a theistic evolutionist, to the environmental ethic also sidesteps the theistic dimensions of their personal philosophies.

For the general reader, *To Govern Evolution* may appear to be a well-reasoned application of scientific discoveries and religious history to the betterment of mankind. To the astute scholar, however, it comes across as a polemic for global control of human populations in the interest of powerful private interests, such as wealthy transnational foundations that manipulate national governments to their own benefit. While not a professional reference work (it lacks an index), the book does provide a good example of that genre of provocative literature that stimulates serious discussion of the political manipulation of both science and religion. It should cause the reader to question the *total* price of technological pragmatism in light of past abuses, not only to man's environment but to man himself, especially his humanity. It should raise the questions: who writes the "scenario for global governance" and who obeys? What are the "shared values and beliefs and myths and customs" of a global culture about which the author says: " . . . although I am certain it is already here, I am not at all sure what it consists of . . . "? How does a global biopolitical culture differ from Orwell's *1984* and Huxley's *Brave New World*, if at all? If national political power corrupts nationally, what would prevent absolute global governance from corrupting universally and absolutely? Would the Golden Rule evolve into, "He who has the gold makes the rule"?

Anderson's ideas are not new. The politicizing of science and the secularizing of religion in the name of progress, however, become more acceptable for some when technological feasibility replaces moral accountability. In Anderson's vocabulary, the term "adventure" replaces "problem," and experiences replace solutions.

Reviewed by Lazarus Walter Macior, Professor of Biology, University of Akron, Akron, OH 44325.

CHRISTIAN FAITH AND PUBLIC POLICY: No Grounds For Divorce by Arthur Simon. Grand Rapids, MI: Eerdmans, 1987. 120 pages. Paperback; $6.95.

Arthur Simon is executive director of Bread For The World, "a Christian citizen's movement against hunger" begun in 1974. Arthur became involved in political action in his brother Paul's campaign for the Illinois House of Representatives while a student at Concordia Seminary. Paul won the election and has continued in public service, presently in the U.S. Senate, while Arthur entered the pastoral ministry, first serving the small inner-city Trinity Lutheran Church on the Lower East Side of New York, a congregation of mainly economically poor people. Involvement of his congregation in neighborhood issues like hunger led to the development, over several years, of a Christian citizens movement.

Simon focuses on hunger, and this is the primary issue used in making his case for citizen action. He makes a fundamental distinction which is basic to his thinking about Christian involvement in the public arena: "the distinction between the separation of Church and State on the one hand, and the separation of religion and life on the other hand" (p. 12). This book was written by Simon primarily to address issues relating to hunger, such as changing public policy and Christian involvement in trying to influence public policy. Simon does not question the value of private assistance, but stresses the importance of government and, using hunger as primary example, presents four arguments for public (i.e., government) intervention. Very briefly, the arguments may be summarized as follows: 1.) A national and international problem requires national and international commitment, 2.) The size of the problem and resources to address the problem require government involvement, 3.) Private aid is reinforced by and needs government action, and 4.) Decisions that need to be made can only be made by the government.

Following the arguments to establish the necessity of government action, Simon discusses how to develop an agenda for action. This is an excellent discussion, one I would recommend all Christians read. According to Simon, we need "a more humble and biblical approach . . . one that can see the distance between fundamental principles, about which we can have the certainty of faith, and policy prescriptions, which are inevitably flawed" (p. 52). As an instructive example of how congregational involvement can make a significant difference for effectiveness, Simon discusses the Roman Catholic bishops' pastoral letter on the nuclear arms race. In terms of its effect on the thinking of Catholics, Simon states: "I am aware of no other instance in which a religious statement on a public policy issue has brought about such a change" (pp. 78–79).

This book also contains three brief additions at the end: an appendix on how to contact members of Congress, an appendix stating the Right-To-Food Resolution proposed by the U.S. Senate, and two pages of discussion questions.

This book presents rather limited arguments for Christian involvement in public policy issues, and is primarily limited to the issue of national and world hunger. As mentioned above, the chapter on developing an agenda for political action is certainly recommended reading. Simon has successfully demonstrated that concerned Christians can be effective in influencing public policy decisions. This is an important book to read for all of us who are concerned about where our society is headed, but who feel inadequate to do anything about it.

Reviewed by Bernard J. Piersma, Professor of Chemistry, Houghton College, Houghton, NY 14744.

NUCLEAR ARMS: Two Views on World Peace by Myron S. Augsburger and Dean C. Curry. Waco, TX: Word Books, 1987. 186 pages. Hardcover.

This book is one of a series of volumes projected to deal with controversial social issues confronting evangelical Christians. Under the general editorship of Vernon Grounds, former president of Denver Theological Seminary, each book will provide two contrasting views on a particular issue. In *Nuclear Arms*, Myron S. Augsburger presents the case for

nuclear disarmament and Dean C. Curry argues for the necessity of a nuclear deterrent force.

Augsburger comes from an Anabaptist background. He is currently an adjunct professor of theology at Eastern Mennonite Seminary and serves as a member of the General Board of the Mennonite Church. His background and training make him a highly qualified spokesman for the pacifist tradition in American Christianity. Curry is the chairman of the history and political science department at Messiah College. While both men are very capable, their backgrounds are quite dissimilar, and this is reflected in the very different style and tone of their presentations. Curry's training in international relations and history comes through clearly in his presentation, while Augsburger adopts a more theological tone. Both writers, of course, appeal to Scripture and try to derive guidance for our present troubled world from general biblical principles. Both have presented an excellent case from their own perspectives.

The book is divided into three parts. Part I, "The Nuclear Dilemma: A Christian Peace Approach," contains a 68-page statement of Augsburger's views. Curry's basic presentation in Part II covers 78 pages, and is entitled "Building Peace in a Nuclear World: A Christian Defense of the Just War Tradition and Democracy." In a final section, the two writers take about ten pages each to present final arguments in response to each other.

To Augsburger, the greatest moral issue facing humanity is the necessity for ending the nuclear threat. Although he is a strict pacifist himself, he believes that even Just War Theory advocates should now admit that the use or possession of a nuclear force could not be within the guidelines of the Just War tradition. Or put more simply, there is no way that nuclear weapons can be controlled so that their destruction will not fall upon combatants and non-combatants alike. For this reason, many Just War advocates now have joined with pacifists in calling for nuclear disarmament.

Curry argues that such an approach obscures the nature of the moral issue. The greatest issue is not a technical one about what kinds of weapons should be permitted. The paramount question is whether the American Democratic system should be defended against the real threat of totalitarianism. The government is obligated under God to protect its citizens. Christians cannot afford to simply ignore the record of Marxism-Leninism in this debate. The slaughter of millions by Stalin in the 1930's and the genocide of the Khmer Rouge are only the short list of examples of Communist disregard for human rights and life. Nuclear weapons are not moral or immoral *per se*. Curry believes that it is only as we consider the intention or purpose for possessing such weapons that we come to a moral issue. He sees the U.S. purpose as justifiable in light of the real danger of a totalitarian takeover of our nation.

The two authors' viewpoints also diverge on the question of Christ's kingdom and the effect of a sinful environment upon its operation in this world. Augsburger thinks that Christians in the present age need to apply Jesus' teaching on love and justice in a way that can demonstrate to government leaders that there are alternatives to violence as a means for resolving conflicts. Curry, however, believes that man's fallenness makes the present actualization of many of the more ideal aspects of the kingdom a present impracticability.

There are incisive discussions of many important issues that Christians need to become aware of in both essays. How should the Christian, as a member of the global Christian community, relate to his own nation? Can a Christian legitimately be a nationalist? Would an assault on poverty, hunger, and other injustices in the Third World be a viable method for reducing the threat of war? What are the natures of the pacifist and Just War traditions in Christianity, and how has the present nuclear age affected the contemporary development of these different approaches? Most importantly, every serious-minded Christian should recognize the need for approaching the present nuclear crisis from a biblical perspective. Augsburger and Curry have suggested two very different approaches for considering this issue. Despite diversity of opinion, the importance of the question demands attention. This book should help Christians to arrive at or clarify their own positions.

Reviewed by Richard L. Niswonger, Professor of History, John Brown University, Siloam Springs, AR 72761.

TO CARE FOR THE EARTH: A Call to a New Theology by Sean McDonagh. Santa Fe, NM: Bear, 1987. xi + 224 pages, bibliography, index. Paperback; $9.95.

First published late in 1986 by Cassell in Britain, where it was enthusiastically reviewed, this book makes a fairly modest but important contribution to the ever-expanding literature of Christian environmental theology and ethics in the 1980's. Here is an introductory theology of nature that includes a definite natural theology. Meister Eckhart's well-known claim that "every creature is a word of God and a book about God" could have served as the author's motto.

McDonagh is an Irish Columban missionary who used to live on the island of Mindanao in the southern Philippines, and who now works at the Santa Cruz Mission in the Philippine province of South Cotabato. A theologian and social anthropologist, McDonagh also lectures part-time at the Pacific Mission Institute in Sydney, Australia.

To Care For the Earth is quite readable, and based not only on the author's reading and reflection, but also on his personal experiences of the natural and social worlds of Ireland and the Philippines. The book will interest those concerned with the relation of religion and ecology; missionary practice and world evangelization (especially as this emerges from a biblical vision of justice, respect, and wholeness, not only for humanity but for all creation); theology of nature, as informed by scripture, science, and feminism; and an active environmental ethic rooted in "creation liturgy" and spirituality, emphasizing prayer, cosmic christology, and

the sacramental presence of God in nature.

The book is divided into two parts. The first part surveys the escalating threat to life on earth posed by human activities marked by insensitivity and irresponsibility—by everything but the divinely-intended *shalom* for creation. Industrial contamination of land, sea, and air; soil erosion; acidic and toxic rain; the destruction of the world's tropical rainforests, along with entire species blessed, presumably, by God; energy profligacy; consumerism; economic and political injustice—McDonagh names most of the ills and evils of the world and shows how they are linked together to form one malignant whole. Following this, he discusses the death of the old cosmography, the birth and senescence of the mechanistic world view of the scientific revolution, and the rise of a "new story" of the world, based on a theistic reading of modern cosmology, physics, and evolutionary theory. The "new story" provides us with a scientific *cum* religious "myth" that can inspire faith and action, and overcome erroneous dualisms (transcendence/immanence, matter/spirit, sacred/profane).

The second part of the book outlines a new theology of creation that values nature, not instrumentally, but for its own sake, and as a manifestation of the divine. McDonagh understands God as a primal, animating, sustaining, and redeeming presence throughout the universe. The Holy Spirit, as the "feminine dimension of God," is the "principle of communion, binding all reality together . . . the one who inspires all fruitfulness and creativity," healing what is broken, recreating what is lost (p. 119).

McDonagh's analyses and arguments move easily back and forth between concrete cases and biblical/theological commentary. His account of the killing of the forests in the Philippines, for example, is not just the sad tale of the conjunction of economic interests, technological power, and biological disaster. Since the forest region is also a habitat for the T'boli, the story has a political dimension as well. But the destruction of the forest is much more than an injustice to native people whose art, music, and medicine, whose food and shelter, are all intimately bound up with the life of their environment. It is an injustice—indeed, a sin—against *creation itself*, whose parts have intrinsic worth, having been blessed by the God who called them into being, and who sustains them by a holy presence. For McDonagh, as for Aquinas (see the *Summa Theologiae*, Pt. I, Qu. 47, Art. 1), the whole created cosmos communicates, manifests, and participates in the original, divine goodness.

The intellectual sources behind *To Care For the Earth* are varied, and not all of them will be equally familiar or palatable to readers of this journal. First, there is the Bible, especially the early chapters of Genesis, the classic nature-Psalms, and parts of the Pauline corpus of the New Testament. Doctrinally, McDonagh stresses the themes of covenant, sin, redemption, incarnation, and the Spirit. For him, the historical Jesus has been glorified into the cosmic Christ, everywhere present, as in the poem by Joseph Plunkett, "I see his blood upon the rose." It's worth quoting the last verse of this hymn, for it's steeped in a Catholic Celtic tradition that pervades the book:

> All pathways by his feet are worn,
> His strong heart stirs the ever-beating sea,
> His crown of thorns is twined with every thorn,
> His cross is every tree.

Other classical sources the author recovers include the monastic stewardship ideal of St. Benedict, the humble kinship with all creatures taught by St. Francis, and the writings of the unjustly neglected 12th-century naturalist, theologian, artist and mystic, Hildegarde of Bingen. McDonagh is also concerned to find allies in other world and tribal religious traditions that remember and cherish the sacredness of earth and sky and water. He owes an additional debt to the evolutionary scientist and seer, Teilhard de Chardin.

Perhaps the influence that does most to set the tone of this book is the vision of Passionist priest and self-styled "geologian" Thomas Berry. (A good introduction to his thought is the sympathetic yet critical 1987 symposium edited by A. Lonergan and C. Richards, *Thomas Berry and the New Cosmology.*) Berry is co-apostle, with Matthew Fox (another left-wing Catholic father, though more scholarly), of "creation-centered spirituality." He sees nature as the primary—perhaps even definitive—revelation of God; indeed, it might be argued that Berry seems to have abandoned both the Bible and Jesus for a quasi-pantheistic worship of nature inspired by a rather romantic interpretation of late 20th-century cosmology. I wouldn't call McDonagh a groupie (a type both Berry and Fox attract), but he's a trifle too enthusiastic for my taste. Like generations of science-and-religion reconcilers, McDonagh follows Berry in being too ideologically unsuspicious toward science, too deferential to whatever passes as the latest scientific word of truth.

Despite the difficulties Protestant mainline and evangelical readers may have with this book, I'd still recommend it; especially if read alongside John Carmody's *Ecology and Religion* (1983), Evans and Cusack (eds.), *Theology of the Land* (1987), Wesley Granberg-Michaelson's *Worldly Spirituality* (1984) and *Tending the Garden* (1987), John Hart's *Spirit of the Earth* (1984), Joranson and Richards (eds.), *Cry of the Environment* (1984), Jürgen Moltmann's *God in Creation* (1985), and Paul Santmire's *The Travail of Nature* (1985).

Reviewed by Paul Fayter, Institute for the History & Philosophy of Science & Technology, University of Toronto, Canada.

SECOND NATURE: The Animal-Rights Controversy
by Alan Herscovici. Toronto (Ontario), Canada: CBC Enterprises/Les Entreprises Radio-Canada, 1985. 254 pages, index. Paperback; $12.95.

The modern animal-rights movement sees itself as bringing humans closer to nature by protecting the life of every animal. In fact, however, this philosophy widens rather than heals the gap between humanity and nature and is a symptom, not a cure, of humanity's alienation from its environment. So says Alan Herscovici in his polemic *Second Nature*,

in which he traces the history of the animal-rights movement and describes how it threatens native people such as the Cree Indians of Canada. The animal-rights movement, like the environmental movement, opposes pollution and the extinction of various animal species, but it goes further by rejecting the use of animals for any purpose and is seen by many aboriginal people as just another form of European/American imperialism. That the animal-rights movement is another type of ethnocentrism might be denied by some, but Herscovici, a Montreal-based journalist and broadcaster, argues cogently for this position.

The first part of the book discusses the theoretical origins of the animal-rights cause. Included in this section is a summary of various Western philosophical views on animals and the relationship between humanity and the environment. Herscovici traces the root of the ecological crisis to technology, urbanization, and over consumption by the wealthy, and argues that the animal-rights movement has had its greatest impact on those people who are closest to the land and are as removed as possible from technological advances—the sealers, trappers, and other native peoples.

The second part of this book covers the history of the animal-rights movement's attack on sealing and trapping, and it also includes a chapter on animal-rights groups' campaign against research with animals, and factory farms. In the chapter on sealing, the author discusses how various animal-rights groups used emotional appeals and misinformation to convince the European Economic Community to ban the importation of seal products, even though seals were not an endangered or threatened species. The irony in the passing of this ban is that with it the animal-rights movement, with all its talk about respecting the environment and animals, harmed the very people who are closest to nature, those whose livelihoods depend upon income from sealing. In the author's own words, "Iniut and other hunting people study and respect animals because their lives literally depend on them. It is when we are no longer dependent on our environment, or think we're not, that contact is lost and, with it, respect for other life" (pp. 103–104).

In the chapter on animals in research, Herscovici correctly points out some of the positive influences the animal-rights movement has had on the care of laboratory animals. Scientists are increasingly asking whether their research with animals can be justified by the potential benefits, and alternatives to animal experimentation, or a reduction in the number of animals used, can sometimes be found. However, the author offers evidence that animal-rights groups again used misleading statistics and blatant misinformation in their attacks on laboratory research with animals. Also, the author states his belief that the ultimate and logically consistent goal of the animal-rights philosophy is the removal of factory farms and, consequently, the elimination of meat eating. The attacks on sealing, trapping, and research make no sense if we continue to consume meat in our diet.

In the third section of his book, Herscovici outlines a new relationship with nature, one similar to that which exists in hunting cultures. Only in a culture that sees itself separated from the environment can the animal-rights philosophy exist, and only in a culture divorced from nature can animals have greater rights than unborn humans. The farther we get from nature, Herscovici argues, the better the idea of not killing animals (or plants, for that matter) looks. Only when we see our dependence on nature, like the hunting, trapping, and sealing cultures do, will we truly respect it.

Second Nature was written to show how the animal-rights philosophy has hurt those who are closest to the environment. Some positive aspects of the movement are mentioned, but in general, it is cast in a negative light. The book presents the animal-rights cause in a way not often portrayed in newspapers or on television, and for that reason, it is recommended to those interested in the topic and who want to hear the other side of the controversy.

Reviewed by Kevin Seybold, Department of Psychology, Grove City College, Grove City, PA 16127.

PSYCHOLOGY AND CHRISTIANITY: An Introduction to Controversial Issues by Ronald P. Philipchalk. Lanham, MD: University Press of America, 1987. 234 pages, index. Paperback; $12.75.

Several books have been recently published as supplements to standard introductory psychology texts for use at Christian colleges. Ronald Philipchalk, an associate professor of psychology at Trinity Western University, has written *Psychology and Christianity* as a companion volume to accompany a general psychology text. The three-fold purpose of *Psychology and Christianity* is to: (1) show how the sub-areas of psychology relate to Christian faith, (2) anticipate questions Christian students might ask and provide some tentative answers to those questions, and (3) stimulate additional thinking on integration issues.

The book is divided into 11 chapters, with Chapter 1 serving as an introduction and Chapter 11 as a conclusion. The other nine chapters are organized around a particular sub-area of psychology, ranging from physiological psychology to psychotherapy. The division is similar to most introductory psychology texts. Following a brief review of the subject area, each chapter contains a controversial issue that might be raised by a Christian reading the corresponding chapter in a standard introductory text. Philipchalk then discusses this issue, primarily from a conservative Christian perspective. Additional questions from the sub-area are then proposed and briefly discussed, and each chapter ends with a list of suggested readings and references.

Philipchalk does a good job of summarizing the contribution psychology has made in each sub-area, and of relating psychology's contribution to a Christian understanding of the topic. For example, the chapter on developmental psychology includes a review of Piaget's theories of cognitive and moral development, Kohlberg's theory of moral development, Freud's psychosexual stages, and Erikson's psychosocial stages. The controversial issue raised in this chapter is: Can

developmental psychology aid in the understanding of religious development? Philipchalk presents and then criticizes the position that states that because religious experience is spiritual and not psychological, psychology is irrelevant to the understanding of religious development in the individual.

Philipchalk begins his discussion of the position that psychology is relevant by reminding his readers of the perils of forcing a false dichotomy between religious and psychological explanations of development. He then goes on to describe how developmental psychology, particularly theories of cognitive development, can further the Christian's understanding of certain aspects of religious development, such as questioning one's childhood faith during adolescence. According to Erikson, the critical issue to be resolved during adolescence is the development of an identity which would, in the Christian adolescent, incorporate his or her religious beliefs. This identity is best achieved after freely searching for, and perhaps experimenting with, various alternatives. When the identity is achieved, the religious beliefs that help to make up that identity are truly one's own. So, according to Philipchalk, the parent, pastor, or counselor needs to be aware that while there is a spiritual dimension to this struggle during adolescence, there is also a psychological dimension to it, and understanding this dimension can help the concerned adult react to and deal with the adolescent effectively.

Additional discussion questions in this chapter concern what psychology can tell us about "the age of accountability," moral development in women, guilt, our concept of death, genetics, doubt, and the psychology of religion (i.e., psychological processes in conversion, healing, glossolalia, etc.).

Philipchalk has succeeded in writing a book that can be used by instructors in beginning psychology courses to help the student relate the covered material with Christian faith. The controversial issues raised and the discussion questions posed are indeed those that reflective students will ask, and Philipchalk either answers, or begins to answer, these questions competently and thoughtfully. The book is recommended to those instructors who want to include some integrative work in their introductory psychology course.

Reviewed by Kevin Seybold, Department of Psychology, Grove City College, Grove City, PA 16127.

THE PSYCHOLOGY OF RELIGIOUS BELIEF by L.B. Brown. New York: Academic Press/Harcourt, Brace, Jovanovich, 1987. 218 pages, index. Paperback.

L.B. Brown of the Department of Psychology at the University of New South Wales has produced a short, but reasonably thorough, review of what psychologists who are interested in religious issues have learned to date about the psychology of belief. This is important. American psychologists, as a general rule, are more interested in religious practices, orientations, and attitudes than belief, *per se*. For North Americans who are both scientists and Christians, Brown's book may come as a refreshing change of pace. Many American psychologists share one of two rather disparate points of view. Those of us (I am one of this group) who were trained as scientists, come to religious *behaviors* from what is a quasi-logical positivist, if not a radical behavioristic, approach, and are at the least methodological behaviorists. A second group seems to approach religious issues from a Freudian or a humanistic bias which is equally alien to many Christians. Brown does neither. Instead, he reviews the data and lets the chips fall where they may.

Brown begins with a simple history of the study of religious psychology with its first empirical attempts at simple counting, and moves succinctly in the first four chapters through definitions, theoretical approaches to identifying the "religious variable," and on to measurement and its problems. Upon this base, Brown summarizes a broad array of published research—over 700 references are cited. Again, he is clear and concise and, while in chapter 6 he briefly critiques ten "not necessarily eclectic" approaches and offers a beginning toward a "coherent" approach, the emphasis is primarily upon what has been reported. Here, and in the excellent conclusion, he is particularly sensitive to the role of tradition: "religious beliefs are not independent of the traditions that sustain them or of the experiences that realize them" (p. 205).

Both chapter 9 (Readiness for Religion) and chapter 10 (Conclusions) deserve special comment. The former might seem to be Brown's chapter on the developmental psychology of religious belief, and, in a way it is; most of the usual sources are cited. However, it is something more. His comparisons of whether religion is "taught" or "caught," and his citing of research which is not usually available to Americans on these topics makes for a valuable contribution. The concluding chapter is superb, and if one read only that section, he would probably want to read the whole book.

Having said this, the reader must be warned that Brown's editors have set the book in a small, dense type-face which I found caused considerable eye strain. Throughout the book there are only three figures and eleven tables to break this density, and several of the tables are almost as packed as the text. Reading this book could be hard sledding for someone not already fairly familiar with most of the data Brown uses.

Reviewed by Al L. Cone, Professor of Psychology, Jamestown College, Jamestown, ND 58401-3401.

A GODLESS JEW: Freud, Atheism, and the Making of Psychoanalysis by Peter Gay. New Haven, CT: Yale University Press, 1987. xvii + 177 pages, index. Hardcover; $17.95.

Peter Gay's postulation that psychoanalysis could only have been created by an atheist confirms what many Christians long have believed, that psychoanalysis is incompatible with revealed truth, or at best a very dim reflection of it. The

unique appeal of this essay is that its author, a preeminent, cultural historian, should so eloquently argue along the lines of the intuitive, religious right. As Sterling Professor of History at Yale University and a graduate of the Western New England Psychoanalytic Institute, Gay is particularly well qualified to deal with the historical origins of psychoanalysis.

In 1918, in a letter to a friend, Freud asked the questions which serve as the *leitmotif* for this work: "Why did none of the devout create psychoanalysis? Why did one have to wait for a completely godless Jew?" Gay begins his answer by establishing Freud's "fundamental conviction that there are two wholly incompatible styles of thinking in the world, the theological or metaphysical on the one hand, the scientific on the other, and that no mental gymnastics, no effort of will, can ever reconcile them" (p. 32). He goes to extraordinary lengths to make it clear that Freud was neither "godless" by default nor a tepid agnostic, but rather a militant atheist who "advertised his unbelief every time he could find, or make, an opportunity" (p. 5). The religious philosophy of William James is skillfully utilized as a backdrop to Freud's absolute rejection of religious truth. "If Freud had been a believer like James," Gay asserts, "he would not have developed psychoanalysis" (p. 31).

In chapter one, "Science Against Religion," Freud's "godlessness" is traced to its roots in the secularism of the Enlightenment. Gay, who during the 1960's established his reputation as a leading interpreter of the Enlightenment, finds in Freud not only the searching curiosity of the philosophers, but also their methods, language, and self-assurance. Chapter two, "In Search of Common Ground," is Gay at his best, eschewing for a moment his polemic in order to assess the now-obscure reactions of men of God, both Christian and Jewish, who attempted to reconcile the world views of Freud and the Bible. Gay concludes, as many astute observers have, that "all this peacemaking . . . has amounted to very little" (p. 110). In the final chapter, Gay turns to the anticlimactic and rather odd question of whether the new science was peculiarly Jewish in nature. During the early twentieth century, many suggested that it was. Freud himself was intensely conscious of his Jewishness, and found it indispensible in freeing himself from prejudices which inhibited Christian scholars and scientists. Yet after careful discrimination between the variety of senses in which Jewishness may be discussed, Gay concludes that Judaism was "inessential" to the creation of psychoanalysis.

For all the erudition of this essay, nagging questions remain. What Gay has really demonstrated is that Freud believed atheism to be central to the development of psychoanalysis. He hardly addresses the question of whether or not Freud was correct in his belief. Only the most stiff-necked among Christians today contest the reality, in Paul Tournier's words, "of the mechanisms by which feelings of guilt are aroused, [or] the importance of Freud's discovery" (p. 91). Most would also agree that much within the structure of psychoanalysis confirms biblical teaching. More generally, most Christians recognize the worth of scientific research without accepting all the philosophical implications of that work. Hence, one depends upon the fruits of medical research and skill without rejecting God's omnipotence.

In pursuing his thesis, Gay fails to do justice to the varieties of belief in both God and science. If simple-minded Jews and Christians have refused to believe that Freud's work contains even a modicum of truth, it must be remembered that simple-minded secularists have placed unbounded and unwarrantable faith in science. And though Freud himself was too sophisticated to believe that science would lead to a utopia, there were sophisticated psychologists too, most notably William James, who believed that "religion . . . must necessarily play an eternal part in human history" (p. 30).

Freud and many of his disciples believed that science would eventually undermine all religious faith among the educated. However, from Freud's day until our own, respected psychologists and psychoanalysts have "found a place in psychoanalytic thinking not just for the religious spirit but for the Christian spirit" (p. 108). The points at which psychoanalysis and religion are compatible will continue to be debated. However, unless one adopts Freud's own naive view that there is only a single manifestation of truth, one must recognize, however reluctantly, that psychoanalysis has broadened our understanding of what is true in human nature. Although Gay fails to establish that atheism was central to the founding of that iconoclastic science, his elegant essay raises many questions regarding the relationship between man, his discoveries, and revealed truth which the faithful will do well to grapple with.

Reviewed by John Powell, Assistant Professor of History, Hannibal-LaGrange College, Hannibal, MO 63401.

THE PSYCHOLOGY OF HAPPINESS by Michael Argyle. New York: Methuen, 1987. 256 pages. Paperback; $14.95.

Are you happy? Before you answer, let me tell you that Argyle indicates that this question is more complicated than it seems. For example, a complicating finding is that happiness is not the opposite of unhappiness; these two dimensions are almost totally independent of each other.

Argyle provides the reader with information on the factors relevant to happiness/unhappiness. For instance, the correlates of happiness are extroversion, education, employment, social participation, positive life events, and satisfying leisure. Unhappiness is correlated with neuroticism, low social status, women, poor health, low self-esteem, and stressful life events.

This book has lots of data garnered over the years by scientists concerned with positive and negative feelings. For instance, one study revealed that on the average, American female students are slightly happier than American male students. If happiness is judged by how many physiological symptoms (e.g., headaches) people have, men come out better with just over two, while women rate at four.

How does religion relate to happiness? Prayer as an expression of religion is sometimes used as a means of trying to

restore happiness. However, those who use it are likely to be less educated than those who do not. Religion is more important to women and the elderly than to men and the young. Religious people feel less lonely than others. People who feel that life has meaning are more likely to be happy than people who do not. Religion is related to health, as evidenced by religious people having a much lower rate for heart disease, lung complaints, cirrhosis of the liver, and some kinds of cancer. Church-goers have a much lower suicide rate than others. Despite their low incomes, the clergy are particularly well adjusted, no matter what their ages.

In summary, this book discusses happiness in relation to its definitions, its incidence, its causes, its correlates, and its enhancement. Although much of the data is old, and some of it is from abroad, it is nevertheless useful in forming a concept of happiness. Readers will likely be surprised that so much research has been done on this topic. However, they will be enlightened, entertained, and stimulated in their thinking about happiness.

In closing, those who want to find out what the Bible has to say about happiness will not find much help in the King James Version of the Bible. The word "happiness" never occurs there. ("Happiness" has made its way into some of the more recent translations, especially in the Psalms and the Beatitudes.) This is not to say that most of the ideas related to happiness are omitted from the Bible. What it means is that the abundant life Christ came to bring His followers is usually captured by such words as joy, peace, hope, forgiveness, love, success, and prosperity.

Reviewed by Richard Ruble, John Brown University, Siloam Springs, AR 72761.

CHANGING VIEWS OF THE HUMAN CONDITION by Paul W. Pruyser (ed.). Macon, GA: Mercer University Press, 1987. 200 pages, appendix, index. Paperback.

This book of readings was produced as a result of ongoing annual meetings between behavioral scientist/clinicians and theologians at the Institute for Ecumenical and Cultural Research on the campus of St. John's University in Collegeville, Minnesota. The Institute for Religion and Human Development, also located at St. John's, was a joint sponsor of these series of meetings which were held for a week during each summer for a period spanning five years.

The book contains material which reflects the tension and ambiguity of life. Pruyser acknowledges that the title is deliberately ambiguous. Does the wording mean to suggest that views of the human condition are or have been undergoing change? Does the title reflect the belief that people may be persuaded to change their own and other people's views of the human condition? The answer to both questions is "yes," according to the editor. The objective of this taskforce was to respond to the following rather global question:

> Can what the Jewish and Christian traditions know about the human condition be put in genuinely reciprocal relation to basic dimensions of modern social-scientific knowledge of the human condition, for the enrichment of both? (p. 1)

There are eleven full chapters and a short epilogue by the editor. If there is a central theme, or thrust to the various chapters, it would seem to be that the human condition is best understood as a process. The emphasis is upon transformation, change, and growth as opposed to the idea that mankind is essentially static. This view has both a strong biblical basis as well as being parallel to the current dominant view of developmental psychology; i.e., the "life span developmental perspective." On the other hand, the writers recognize and acknowledge mankind's creatureliness, so this is not just the familiar "each day in each and every way mankind is getting better and better."

Runyon's discussion (chapter 4) of what it means to be made in the image of God was of particular interest to this reviewer. Rather than the usual catalog of parallel traits or capacities between God and mankind, Runyon argues that God's image is not a possession any more than a covenant is a possession. Rather, it is a relation that is dependent upon a continuing partnership that extends into the future. He illustrates this by quoting Sri Lankan theologian D.T. Miles:

> The image of a king's head on a coin is part of the coin and cannot be separated from it. Even if the king dies, the image remains on the coin. But there is another kind of image. On a still and cloudless night we may see the image of the moon in the water of a lake. So long as the water is unruffled by wind, and the moon not covered by cloud, the image will shine out clear and beautiful. But if a cloud comes between the moon and earth, the image will disappear or if the water is ruffled by wind, the image will be scattered and distorted. Thus the image of the moon in the water does not belong to the water in the same way the image of the king on the coin belongs to the coin. The image depends upon a certain relation between the moon and the water. (p. 21)

This will not be everyone's cup of tea, but for those with strong interests in the integration of psychology and theology, there is much to think about in this book.

Reviewed by Craig E. Seaton, Associate Professor of Psychology & Sociology, Trinity Western University, Langley, B.C., Canada.

SELF-TALK, IMAGERY, AND PRAYER IN COUNSELING by H. Norman Wright. Waco, TX: Word Books, 1986. 180 pages, appendices, index. Hardcover.

The great number of books written in support of Christian counselors has made choosing appropriate reading material a real chore. In one sense it is a very positive development. On the other hand, there is much material with ostensible Christian trappings that is psychologically unsound, intellectually unsophisticated, and very idiosyncratic. For these reasons, it is extremely important to know about the expertise of the author if you are not well-trained in the behavioral sciences yourself. This book is one of a series of volumes under

the general editorship of the widely respected Gary Collins. Some volumes have been published and others are forthcoming. The author of *Self-talk, Imagery, and Prayer in Counseling* is a prolific writer, seminar leader and licensed marriage, family, and child counselor based in the Los Angeles area. He also has had extensive experience as a seminary professor, and has worked as a minister of Christian education in a church.

Norman Wright has written many books, most of which are targeted for laypeople. In recent years, he has produced books largely addressed to clergy or lay workers within the church; e.g., *Crisis Counseling* (1985). One hallmark of his writing is its straight-forward quality in which he provides well-organized summaries of various issues under discussion. His writings are generally characterized by a strong "hands on" or "how to" quality.

This book shares many characteristics of his other work—namely its brevity, clarity, and solid biblical foundation. Wright begins with an overview of the basics of counseling, and moves on to identify with the psychological school of thought "cognitive behavioral perspective." Basically, this is the view that just as one's mental life may cause numerous moral, psychological, and even physical difficulties, it may also be the source of healing, renewal, and growth. He provides a brief "tip of the hat" to Aaron Beck, one of the pioneers of cognitive therapy. But the foundation for this approach and its current wide application is not really discussed in any detail. One of the early significant Christian applications of cognitive therapy is Lawrence Crabb's *Basic Principles of Biblical Counseling*. I believe his brief but insightful work would be enriching for the interested reader of Wright's book.

It is a bit surprising that Wright did not deal at greater length with the psychological foundation for the use of imagery. Also, despite the fairly strident criticism that several Christian authors have made of the use of imagery in devotional life and in therapeutic contexts, Wright does not really confront the issue. A full discussion could have enhanced the value of the book considerably.

This book may stimulate the interest of Christian lay counselors and clergy to explore a cognitive perspective and the systematic use of prayer in counseling. It seems unlikely to make many converts in the use of imagery in its current form. An expanded revision, which addresses the imagery issue from both a psychological and theological perspective, would be a most welcome contribution.

Reviewed by Craig E. Seaton, Associate Professor of Psychology & Sociology, Trinity Western University, Langley, B.C., Canada.

ANSWERING FOR FAITH: Christ and the Human Search for Salvation by Richard Viladesau. New York: Paulist Press, 1987. 251 pages, notes, appendix, index. Paperback; $12.95.

Richard Viladesau, as a professor at the Seminary of the Immaculate Conception, should be well qualified to write on the search for salvation. In fact, *Answering for Faith* is part two of a two-volume set, the first being *The Reason for Our Hope*.

This book contains eight chapters. In the preface, Professor Viladesau states his purpose as an " 'apologetic' in the sense of an effort to uncover the rational grounds for belief in Jesus Christ as God's salvic 'word' to humanity."

The first two chapters review the content of *The Reason for Our Hope* and establish the premises upon which this work is based: (1) the twin facts that human beings have a basic trust in ultimate meaning and are disturbed by the existence of evil require that there be a God who is good, omnipotent, and relevant to the world; and (2) the religious history of humanity leads us to affirm that God has spoken to mankind.

The next three chapters introduce the subject of *this* book: Has God spoken absolutely? Viladesau builds on Karl Rahner's *Foundations of Christian Faith*, from which he quotes extensively. Viladesau takes Rahner's work as a challenge to find evidence in the world's religions that they "anticipated" Christ. Following through on Rahner's challenge, Viladesau leads the reader, through a careful review of the history and tenets of faith of the important (higher) world religions—Buddhism-Hinduism, Judaism, Christianity, and Islam—to the conclusion that God has spoken through all of these religions. He points out, however, that Jesus provides the highest revelation of God's love to mankind and how human beings should show love to each other. Furthermore, it is the claim of Christianity that Jesus was God's absolute word.

Chapter six is devoted to showing that this Christian claim is credible. Viladesau bases his conclusion on Rahner's argument: (1) resurrection is required to satisfy the hope of mankind; (2) resurrection is reasonable in light of our own experience of the supernatural; (3) resurrection is the logical outcome of Jesus' life and message; (4) the tomb was empty; and (5) the disciples were transformed from cowards to bold witnesses. Furthermore, Viladesau sees no *a priori* reason why there could not be other resurrections. He concludes that, however, Christ's resurrection was unique.

In chapter seven, Viladesau tackles one final question: since Christianity has received God's highest revelation, what is its responsibility? The responsibility is two-fold, according to Viladesau. First of all, Christians should help adherents of these other faiths incorporate the higher (Christian) revelation of how human beings should show love to each other. Secondly, Christianity should enrich its message by incorporating aspects of the revelations of these other religions.

I found Viladesau's review of the major world religions informative and helpful. His argument that the Church proclaims the message of Christ through the lives of Christians, not just the words they speak, is timely and important. I agree that it is good for Christians to be open to God's voice through other channels than strictly Christian ones. I think, however, that Viladesau takes his case too far in implying that the goal of evangelism should be simply to improve other religions by helping them to incorporate Christian principles.

Furthermore, because the author uses *loc. cit.* rather than repeating the name of references, a bibliography would have aided the reader in finding the source of quotations.

It is not clear to me for what audience this book is intended. The author seems to be trying to impress the reader with high-sounding words. Only a student already initiated into the terminology, or someone who had promised to read the book for review, is likely to make it beyond the first three chapters.

Members of the ASA may find the chapters on other religions informative and helpful. As far as helping non-Christians become Christians or preparing Christians to better present Christ's message to today's world, however, *Answering for Faith* has little to offer.

Reviewed by Elizabeth M. Hairfield, Professor of Chemistry, Mary Baldwin College, Staunton, VA 24401.

THE QUEST FOR FAITH: Reason and Mystery as Pointers to God by C. Stephen Evans. Downers Grove, IL: InterVarsity Press, 1986. 143 pages. Paperback; $4.95.

This small book, written by the general editor of InterVarsity Press' *Contours of Christian Philosophy* series, is an apology for Christianity, a statement of basic Christian theology, and more specifically an attempt to remove the barrier to belief for those who find Christianity "appealing, but incredible" (p. 9). This book is not a member of the *Contours* series, nor is it a philosophy of religion book, yet it introduces a large number of issues that are certainly a part of philosophy of religion.

The book begins with possible barriers to faith including some of the claims of biology, psychology, sociology, anthropology, and philosophy which a college student is likely to encounter. It would be easy to read this as saying that all sociologists, for example, "debunk religion" (p. 15). Evans misses a chance to state clearly that there are many Christian psychologists, philosophers, anthropologists, and so on. He argues against skepticism by claiming that in practice one is either a believer or an unbeliever, and that faith is involved in all sorts of things (with specific reference to the *Humanist Manifestos*).

The author makes it clear that the basic question is not whether belief in God is useful or practical, but whether or not it is true. And if we are to reason about that, we must be concerned not only with why someone may or may not happen to believe, but with whether there are good reasons to believe. Yet if there is a God, and He wants us to choose freely to believe in Him, then He cannot force us to believe nor can he make His existence too obvious. "Good evidence will clearly point to God's reality, but it will not do so in a coercive fashion" (p. 34).

Evans says that we should not require a higher standard of proof in religious cases than we require for nonreligious cases. He also says that when it comes to arguments for God's existence they are usually considered individually, and "there is no attention given to the possibility that the arguments might have great force if taken collectively" (p. 25). However, his analogy of convicting a criminal with the collective evidence breaks down, since there are so few arguments for the existence of God. Also, if one thinks that the ontological argument involves a logical mistake, then it should have no more force than a misidentified fingerprint. One important point that Evans does make is that belief in God is nothing like belief in the Loch Ness monster. The monster is just one more item in the world that may or may not exist. But if God exists, He is not just *something* in the universe; He is responsible for the very existence of the physical universe.

Evans takes the position that the moral law is "obvious" (p. 46), that it is something "we are all aware of" (p. 45), and that it is not the product of man or his culture. If this is true, it is good evidence of the existence of a lawgiver. However, Evans is unable to establish these claims. He says it is hard for the relativist to explain the similarities of belief in many different cultures. I think it would be rather easy, given the common makeup of human beings everywhere on the globe. An "even more difficult problem" (p. 47) for the relativist is that "we cannot help comparing cultures and recognizing some cultural practices as merely superior. . . . The conclusion is inescapable; the standard of morality has a reality deeper than culture" (p. 47). Yet, in fact, if we got our moral views merely from our own culture, we would expect people to think other cultures were mistaken.

One important point made is that even if evolution is an explanation of much of the order in the universe, that order is dependent on the orderliness of the laws of nature. "The visible order which is so manifest around us is shown to be dependent on a deeper, invisible order, the laws of nature and the fundamental properties of matter" (p. 41). This point is too often overlooked in discussions of evolution.

All in all, each chapter of the book is important, interesting, and provocative. I think the level of sophistication of argument he has chosen is probably about right for his audience, and there are enough hints of more sophisticated issues that any of us can read it with interest. Although this book is not perfect, it is the best book of its type I have seen.

Reviewed by Glenn C. Joy, Professor of Philosophy, Southwest Texas State University, San Marcos, TX 78666.

JESUS RISEN by Gerald O'Collins. New York: Paulist Press, 1987. 229 pages, index. Hardcover; $16.95.

This is an excellent book on the resurrection. One expects theological competence from the dean of the theological faculty of the Pontifical Gregorian University in Rome. It is especially pleasing to find such a treatment which engages not only academic theologians but also popular books and television, and thus deals with questions about the resurrection which arise in the everyday world.

O'Collins points out that there are three standpoints from which we may consider the resurrection: the theologian's study, a refugee camp or other place of suffering, and the Christian community at worship. He attempts to give adequate emphasis to all three. Chapter 1 looks briefly at the understanding of the resurrection in the patristic era, in the Middle Ages, and to the twentieth century. Then two chapters set out, compare, and criticize the views of eight prominent theologians of the twentieth century: Barth, Bultmann, Pannenberg, Marxsen, Moltmann, Rahner, Küng, and Sobrino. These discussions are careful and well balanced, bringing out both strong and weak points. For instance, the author criticizes the naturalistic presuppositions and subjective bent of Bultmann's ideas about the resurrection, but is also appreciative of his emphasis on the presence of the risen Christ in proclamation, bringing that into intriguing contact with ancient ideas of Melito of Sardis. The description of Rahner's view of the cosmic importance of Jesus' death is valuable, but O'Collins argues that Easter must not be subordinated to Good Friday.

The next two chapters focus on issues central to the reality of Jesus' resurrection: the resurrection appearances, the empty tomb, and the basis and content of Easter faith. Alternative explanations for the biblical evidence, such as "swoon" or "hallucination" theories, are disposed of expertly and with good humor. O'Collins recognizes the need to deal with popular (and sometimes preposterous) claims as well as with academically respectable ones. He is no historical literalist, and recognizes that the biblical accounts of Jesus' appearances and empty tomb cannot be read as if they were newspaper reports. But he sets out the case for their basic truth, and argues on that basis for the reality of the resurrection.

Chapter 6, "The Focus of Revelation," is instructive. Often the resurrection has been used to prove the truth of Christianity, but then has been ignored when other theological topics were treated. O'Collins argues that Easter is not just one among a list of Christian truths, but that "the resurrection of the crucified Jesus works as the organizing center for Christian faith" (p. 149). Christology, the Trinity, Creation, the Church, and Sacraments are then discussed in light of the resurrection.

A Lutheran misses here discussion of Justification as a separate topic. On the other hand, O'Collins' concluding topic, "Peter as Easter Witness," might be omitted in a Protestant treatment. Peter's importance among the apostles is connected with his role as the main witness to the resurrection, one to whom Jesus appeared and the principal proclaimer of the resurrection in the first half of Acts. This needs to be considered in ecumenical discussions concerning a "Petrine Office," and O'Collins has given a careful presentation from the Roman Catholic side.

Concluding chapters on "Redemption and Hope," "The Resurrection and Love," and "Communicating the Resurrection" introduce important themes for further thought. Because Jesus is risen, there is a resurrection hope for the world. The communication of the resurrection requires adequate attention to symbolism, experience, and liturgy.

The book touches but does not explore deeply some areas where theology and science might interact fruitfully. The question of "analogies" to the resurrection (pages 73–75, 95) involves in part analogies with creation, and this can illumine our understanding of creation. (For example, life arising from death on Easter can illumine evolution through natural selection.) In discussing bodily identity and continuity in the resurrection (pages 179–187), it should be noted that the quantum-mechanical view of identical particles sheds new light on the old question of whether or not the resurrection body can be made up of "the same atoms" as the body which died, sometimes posed as a question about cannibalism and the resurrection (p. 17). And while comments on the symbolism of the Shroud of Turin are valuable, some discussion of evidence for and against the genuineness of the shroud would be useful.

Jesus Risen is a very good modern, critical, and general treatment of the resurrection. It is a good summary for theologians, and is quite accessible to informed laypeople. It can be strongly recommended for study and reflection of a core element of the Christian faith.

Reviewed by George L. Murphy, Pastor, St. Mark Lutheran Church, Tallmadge, OH 44278.

AND GOD CREATED LAUGHTER: The Bible as Divine Comedy by Conrad Hyers. Atlanta: John Knox, 1987. 124 pages, index. Paperback; $9.95.

Conrad Hyers, Chair of Religion at Gustavus Adolphus College and best known to ASA members as the author of *The Meaning of Creation*, has written another book superlative both in the richness of its insights and the delightfulness of its text. This book provides further development of one of the topics Hyers addressed in his 1981 book *The Comic Vision and the Christian Faith* (New York: Pilgrim Press). His earlier book compared Christian themes with the different forms of comedy; the present book specifically examines divine humor expressed in the Bible.

To many Christians, laughter and comedy and jokes seem vulgar—certainly this is not what God had in mind when he told us to rejoice and be glad, is it? Hyers documents the consistent biblical theme that God elevates the humble, gives victory to the hopeless, and pays attention to things that we consider trivial. These things are the elements of *comedy*.

After reading this book, one can appreciate that hearty laughter is not incompatible with holiness.

The first chapter, "The Humor of God," introduces humor as part of the way in which humans are in the image of God. If we do not laugh at ourselves, if we take ourselves too seriously, we fall into sin. Hyers points out that the capacity for humor and childlike playfulness separates man from beast, and that we should remain, throughout our lives, childlike in our outlook. Hyers may not realize, but would be pleased to learn, that biologists consider humans to be among the most "neotenous" of mammals; that is, we physically retain childlike features into adulthood.

Hyers notes that the humor of God provides a remarkable agreement between the general and the special revelations. There is a great deal of unnecessary and comic diversity in Creation: "Can we survey the incredible zoo of creatures . . . that have lived through the eons of time, . . . and imagine our world to be simply serious business?" (p. 22). Hyers would have agreed with the great biologist J.B.S. Haldane: God must have had a sense of humor, since He made so many hundreds of thousands of species of beetles. The Bible, too, contains "a superabundance of things great and small, mostly small . . . " Thus, concludes Hyers, "The 'Book of God's Word' and the 'Book of God's Works,' as Francis Bacon phrased it, evoke the kind of reaction that a Mozart opera is said to have evoked in Emperor Joseph II: 'Too many notes' " (p. 23).

The second chapter, "Easter Hilarity," describes Jesus' life as the supreme illustration of God's humor. The very thought that this "powerless man, with no political aspiration and no economic or military base" could be the focus of history seems absurd to humans, "a stumbling block to Jews and folly to Gentiles" (p. 31). The fourth chapter, "Mary Had a Little Lamb," develops this idea further. We, like the Magi, would have expected Jesus to be born in a palace, and instead we find Him in an animal shed. The third chapter, "A Chosen People of God Contest," indicates that the history of Israel follows the same theme, in which God's promises are showered upon those least in the eyes of the world. The fifth chapter, "The Blue Book of Social Usage," contrasts human society's viewpoint, represented by Emily Post, with God's viewpoint, represented by Luke 14:12–13. God invites the outcasts of society to His feast. "A poor widow's pennies may outweigh talents of gold and silver. Children may be closer to the kingdom of heaven than Jesus' own disciples. Tea is taken with publicans rather than people of high repute. . . . Untouchable Samaritans . . . become moral examples. . . . Nobodies stand up and are counted. . . . And the meek inherit the earth" (p. 50). Hyers should have mentioned that when the apostles were accused of "turning the world upside down" (Acts 17:6), the accusation was correct.

There is a serious side to this book. In the seventh chapter, "The Day Jonah Swallowed the Whale," Jonah is depicted as being so enamored of his own importance that he was angry at God for forgiving the Ninevites. Our overgrown self-importance, and our inability to forgive, is presented in the last chapter, "The Comic Vision in a Tragic World," as the source of our strife and bloodshed. For our survival we need God's humor.

Why should scientists be interested in this book? Because it reveals an important and often neglected side of the personality of the Creator. Whatever aspect of the interaction of Christianity and science we study, we should not overlook God's redemptive and creative humor.

The funniest thing about this book is its price: $9.95 for only 120 pages. But I don't regret buying it.

Reviewed by Stanley Rice, Department of Biology, The King's College, Briarcliff Manor, NY 10510.

SYMPHONIC THEOLOGY by Vern S. Poythress. Grand Rapids: Zondervan, 1987. 128 pages. Paperback.

Poythress, Associate Professor of New Testament at Westminster Theological Seminary, defends the use of multiple perspectives in theology. He begins by demonstrating that one's perspective determines what one observes, in theology as well as in science and other areas. He then goes on to contend that any one perspective is inadequate in providing an understanding of complex realities. That leads him to conclude that an effort to see the same truth from various angles will enrich our understanding of the Bible and theology. He calls this "symphonic theology" because it is similar to the use of various musical instruments "to express the variation of a symphonic theme."

At first glance, the reader might think that Poythress is relativistic in his thinking, since he stresses seeing things from different perspectives. That impression, however, would be erroneous. He insists on the inerrancy of Scripture and the absolute nature of truth, even though he stresses the differences in perception of truth, due to one's interests and orientation.

Poythress, who has written articles for *Perspectives on Science and Christian Faith*, has done wide reading in areas related to his theme. His bibliographical notes throughout the book are very helpful for those who want to do more in-depth study of the issues he raises.

The book is short, simple, and clear. Many examples are given to illustrate the author's thesis that different perspectives are available for viewing any given truth. The weakness in this approach is that the illustrations are too brief to adequately reflect the complexity of the issues dealt with here.

The book concludes with a section reflecting a pastoral concern for peace among those who disagree on the meaning and present manifestation of the miraculous. The author shows how Christians differ on miracles, and then shows how we can consciously adopt another person's perspective for the sake of dialogue and mutual understanding, without giving

up our own perspectives and convictions.

Symphonic Theology is based on mature, theological insight. Especially helpful is the section on miracles, which is irenic in tone while remaining firmly rooted in strong biblical doctrine.

This provocative and suggestive book opened up some new horizons for me, as a North American teaching Bible and theology in Brazil. One way to diminish the risk of unwittingly delivering cultural baggage as though it is the Gospel, is to be open to other people's perspectives on a question rather than simply insisting that our perspective is the whole truth. I look forward to reading Poythress's other books, and some of the others he mentions in his bibliography. I also plan to look back at his articles in *Perspectives*, to expand on what he has presented well but briefly in this slender volume.

Reviewed by Joseph M. Martin, Professor of Missions, Edward Lane Bible Institute, Patroncinio, MG, Brazil.

FRANCIS SCHAEFFER'S APOLOGETICS: A Critique by Thomas V. Morris. Grand Rapids: Baker Book House, 1976 & 1987. 131 pages, bibliography, index. Paperback; $5.95.

Thomas V. Morris, professor of Philosophy at Notre Dame University, has written a friendly but critical analysis of the writings of Francis Schaeffer. His approach is friendly in that he shares the faith Schaeffer defends, and identifies himself with Schaeffer in the work of apologetics. He endorses Schaeffer's approach at most points, though he questions Schaeffer's conclusions.

Three-quarters of the book is given to analysis and evaluation of Schaeffer's work. The concluding section of the book is Morris' original work—a defense of apologetics as a valid Christian enterprise and a valuable tool in winning people to faith, and suggestions on how to formulate an apologetic scheme more complete than Schaeffer's.

Even though Morris obviously appreciates Schaeffer's work, he criticizes several elements of it. He says, for instance, that Schaeffer claimed too much in his conclusions, apparently believing that he had led his readers to a place where the evidence was so conclusive that the only rational response would be to believe Christian presuppositions. Morris assesses this as going beyond the evidence, which shows the possibility but not the necessity of belief.

Another element Morris criticizes is the mechanical model of thought he perceives in Schaeffer's language. It is as though no personal elements are involved in the thinking process, and that a convincing argument could automatically lead to a change in the other person's thinking.

Morris also questions whether people come to faith in the way Schaeffer assumes in his apologetics. He believes that Schaeffer, after his conversion, came to develop the thoughts he presents to his readers. They do not, therefore, chart the way people come to faith, but rather the way people can come to think after they believe.

In Morris's original section, he justifies apologetics and formulates an apologetic scheme. He begins by showing how the language of confirmation theory and probability are useful to proclamation. He rejects the position that limits faith to belief *in* something or someone, insisting that Christian faith also includes belief *that* something is true. In other words, Christian faith consists of assent to propositional truth as well as trust. It has content as well as attitude. Therefore, it is appropriate to defend and explain the content or propositions of the faith. He believes that cumulative confirmation of the truth claims of Christianity are useful in coming to faith, though they can never be sufficient to necessitate faith.

Morris then addresses what he calls "the extra step" in coming to faith: "the active grace of God the Father drawing another to Christ the Son (John 6:44)" (p. 104). He thus shows not only the usefulness, but also the limitations of apologetics. In the final analysis, only God can bring people to faith.

He also adds an important element to Schaeffer's apologetic approach. Whereas Schaeffer dealt with presuppositions, showing how Christian presuppositions explain human experience better than non-Christian presuppositions do, Morris deals with predispositions as well. These "predispositions" are personal factors involved in the person's reaction to each bit of evidence presented. These are beyond the reach of the apologist. Morris therefore concludes: "If even the best of our arguments are finally dependent for their effectuality on predispositions over which we have no sure control, we are forced to recognize *prayer* as the most important part of our apologetic strategy" (p. 120).

Another important addition of Morris' is to add specifically Christian apologetics to the agenda of the apologist. Schaeffer's apologetic is basically pre-evangelistic, leading people to accept a theistic world view, within which they can understand the Gospel. Morris proposes going on to an explicitly Christian apologetic, and refers to proofs of the resurrection of Christ as crucial in that enterprise. He envisions apologetics as a useful tool not only for pre-evangelism (to convince people concerning a personal God), but also in presenting Jesus Christ as God's Son.

Morris has done evangelical Christians a useful service in both his analysis of Schaeffer's works and in his original section on apologetics. The precision and exactness of his work are to be commended. As a philosopher he is careful to say exactly what he means and avoids overstating his case.

As has been observed above, his major criticism is that Schaeffer's conclusions go beyond his evidence, an error Morris is careful to avoid. Granted that Morris' analysis of the facts is correct, as I believe it is, there are at least two possible explanations as to why Schaeffer wrote that way. One is that he was not aware that he was overstating his case. The other is that he was not writing as a philosopher, limiting himself to what he could prove. He was writing as an evangelist, giving

what evidence he could, but wanting to take his readers all the way to commitment to Christian faith. I suspect the latter explanation is the more accurate one, though it was not adequately considered by Morris. Even so, Morris' book is a help both in understanding Schaeffer and his method, and in taking Schaeffer's apologetic/evangelistic work a step further.

Reviewed by Joseph M. Martin, Professor of Missions, Edward Lane Bible Institute, Patrocinio, MG, Brazil.

THE HEALTH AND WEALTH GOSPEL by Bruce Barron. Downers Grove, IL: InterVarsity Press, 1987. 200 pages, indices. Paperback; $6.95.

Barron's book deals with a movement within the Christian church which attracts considerable attention both from inside and outside the Church. What he calls "the health and wealth gospel" asserts that Christian believers who ask God for health or prosperity in sincere faith will receive those gifts. Some Christians support this movement, while others strongly oppose it. In addition, some of the more extreme aspects of the movement, such as deaths due to lack of medical treatment when reliance has been placed on faith alone, subject the movement, and the whole Church, to the scrutiny of non-Christians. Thus, a careful look at the movement is in order.

Barron provides a good mix as he tells the story, interspersing anecdotes of people who have been involved with the "faith" movement, accounts of its prominent leaders, and examination of its theology. He writes as a charismatic Christian who wants to look sympathetically, but critically, at "health and wealth" ideas and practices. The result is a book which holds one's interest.

An introductory chapter introduces some prominent leaders of the movement and its basic ideas. A chapter is then devoted to one of the horror stories, that of Hobart Freeman and the deaths resulting from his insistence that his followers not seek medical help. Freeman is used by the author as a boundary marker, to show extremes which the movement must avoid. And he argues that many in the "faith" movement do avoid them.

The development of the "health and wealth gospel" is described, from its nineteenth century beginnings through such leaders as Oral Roberts and Kathryn Kuhlman to its current big names, especially the Hagins and Copelands, Charles Capps, Jerry Savelle, and Fred Price. The reader is given the chance to see some of the different emphases of these and other teachers.

Chapter four treats the three basic themes of the movement: divine healing, prosperity, and "positive confession." The latter resembles such concepts as "positive thinking." The following three chapters examine in more detail these ideas and the biblical support claimed for them. Concluding chapters deal with the use of the Bible in the movement, the way these teachings work in real life, and an overall assessment.

Barron tries to be as fair as possible to the "health and wealth" movement, and warns against letting it be discredited because of a few extreme teachings or practices. But while the concepts of divine healing, prosperity, and assurance of God's promises need adequate emphasis, the evidence Barron presents seems to me to add up to a pretty devastating picture of the movement. He points out that its teachers generally have no adequate hermeneutic principles—no overall principles of biblical interpretation. This results in such things as extreme generalizations from verses such as Proverbs 6:2 and III John 2. When we read of leaders claiming direct divine revelations which apparently transcend Scripture, we should immediately sense danger. Biblical examples of believers (including St. Paul) who were sick show that faith is no guarantee of physical health, and the way Scripture often stands on the side of the poor and condemns the rich shows that it is hardly presenting a simple prosperity message. Barron points all this out. But it seems a bit naive to say, "Faith teachers need to make a point of reminding listeners that some Christians may be called by God to a life of poverty . . . " (p. 99). Of course they do. But what *sells* is the "God wants you to be rich" message.

Barron gives a well-balanced and informative account of the movement, but some fundamental issues are not explored. The idea that there should be reasonable and verifiable proofs of God's activity—i.e., health and wealth—for true believers is quite different from the biblical theme that God's work is basically hidden under the cross of Christ which all believers are to share. (That is, the health and wealth movement is based on a "theology of glory" rather than a "theology of the cross.") In addition, while "faith" is often spoken of (and even used adjectivally, as in "faith churches," suggesting that other churches do not stress faith), the connection between "miracle working faith" and fundamental saving faith in Christ needs exploration.

Reviewed by George L. Murphy, Pastor, St. Mark Lutheran Church, Tallmadge, OH 44278.

HONESTY, MORALITY & CONSCIENCE by Jerry White. Colorado Springs, CO: Navpress, 1979. 240 pages. Paperback.

Absolute honesty is a biblical mandate according to Jerry White, and in his book White discusses the often difficult task of being completely honest in every aspect of one's life. The book is filled with case studies and examples drawn from White's experiences as a professor of astronautics, General Director of The Navigators, and husband, parent, and church member.

White begins by describing the daily life of many individuals, a life filled with ethical and moral dilemmas, and he

emphasizes that it is easy to become desensitized to dishonesty by the dishonesty of those around us and by the small acts of deception we might commit. Complete honesty, however, is demanded by God, and in the remaining chapters of his book White discusses the role of the conscience in helping us to live honestly in our business, in our home, in the classroom, and in the church.

White succeeds in illustrating how we are continually confronted with decisions to be honest or dishonest. In the chapter on honesty and ethics in business and work, White mentions deceptive advertising, work slowdowns, reasonable profits and wages, and effective use of time on the job as examples of areas where honesty must be considered for the Christian. In the home, White mentions that we model honesty for our children in the way we pay our taxes, in the way we keep our promises, and when we apologize to our children when we have wronged them. The book also contains practical suggestions for improving one's honesty and for confronting dishonesty when it occurs. Throughout the book, White provides scriptural texts to support his advice.

White's book is easy reading, and it is helpful in identifying areas where Christians might slip, however inadvertently, into dishonesty.

Reviewed by Kevin Seybold, Department of Psychology, Grove City College, Grove City, PA 16127.

WHY CHRISTIANS BURN OUT by Charles E. Perry, Jr. Nashville: Thomas Nelson, 1982. 166 pages. Paperback; $4.95.

A first reaction to reading this book was "Oh no!" Another Godless, bloodless psychology tract about how we can 'mind game' our way to better mental health while pretending to be Christians."

I was wrong, and I'm glad of it. However, the book reads very secularly with little more than an institutional reference to Christianity until about halfway through. From that point on, some positive, practical, and scripturally based teaching is given that deals with the whole problem encompassed by the term "burnout."

Why Christians Burn Out is a very easy and short read. Several cases are cited, with their spiritual and temporal resolutions detailed, along with some practical check tests for the reader. References are included at the end of each chapter, which is an unexpected plus for this kind of book format.

Charles Perry presents his book with a pastorate background in the Ohio Valley, and theological training at Grace Theological Seminary in Winona Lake, Indiana. He comes to the subject with first-hand knowledge as a former "burnout" victim.

This book provides a good pulse check for anyone who wants to avoid the serious consequences of spiritual, emotional, and physical burnout.

Reviewed by R.J. Brown, 5397 Duncan Creek Road, Buford, GA 30518.

TELEVISION AND RELIGION: The Shaping of Faith, Values, and Culture by William F. Fore. Minneapolis: Augsburg Publishing House, 1987. 219 pages, index. Paperback.

The author is well qualified to write about religious broadcasting. During his seminary days he wrote, produced, and directed "Exploring God's World," a television program for children. Later, after a brief experience doing children's programming for CBS, he began a life-long career in church communications. Now he serves as assistant general secretary for communications of the National Council of Churches of Christ in the United States.

After a brief discussion of the power and influence of television in our society, Fore deals with several of the best-known religious television programs and their key personalities. He makes the point that although such programs draw large sums of money from their viewers, the audiences are relatively small, and most viewers belong to and support established churches. "Fully 77% of the heavy viewers of religious TV are church members, and almost all of them attend church at least once a month" (p. 105). He adds that religious broadcasts seldom reach the unchurched.

Having placed the religious television stars in perspective, the author explains that the overwhelming influential force in American life is commercial television programming. Most Americans spend "80% of their entire lives" with television (p. 16). And what they see and hear is what Fore calls the television or media world view. A summary of this world view is given on pages 63–68. This "non-Christian view of life predominates in mass media, as it does in the society as a whole. As Martin Marty has pointed out, the 'proper' opinion always dominates, and the Christian view is always the 'improper' opinion" (p. 44). Thus, the activity that takes most of the attention of most Americans does not support, and often ridicules, most of what Christianity stands for. It is this force that is emerging as "the most powerful alternative to the churches" (p. 25). Actually, Fore's book is not about religious television, it is about the conflict between Christianity and secular television in general. The seriousness of the subject is underlined by references to statements by Washington, Adams, and Tocqueville to the effect that, in Madison's words, "our constitution was made only for a moral and a religious people. It is wholly inadequate to the government of any other" (p. 197).

The reason that the media world view almost completely dominates television, as Fore sees it, is our commercial television system. The facilities are very limited, and the

operators and licensees compete fiercely with each other for an audience. Listeners are then "sold" to advertisers, the price depending on the size of the audience. In order to attract the largest possible number of viewers, the networks and stations give the audience what it wants, constructive or not. Even the TV evangelists do this, promising happy, material-rich, and healthy lives to those who will send in sizeable contributions.

Fore thinks that the system needs to be changed, and he suggests that churches get involved. First, members can encourage their congressmen to vote for legislation that would make the system more diversified. For instance, twelve networks rather than three would, he believes, serve some of the smaller audience segments that are too small for the big three to care about. Second, he suggests that established churches learn to communicate the Christian world view to people outside the church, not only by television but also by the use of more personal media such as telephone ministries.

This book is not for general reading, but it could be helpful to the pastor who wants his or her congregation to better understand the threat of commercially dominated television. Also, there are some interesting suggestions for reaching the unchurched with the Christian message. The usefulness of the book is enhanced by end notes and a good index. Any Christian who is interested in television programming in general will find this can serve as a useful reference book.

Reviewed by Ralph C. Kennedy, Professor Emeritus, John Brown University, Siloam Springs, AR 72761.

Letters

Limits to Biotechnology

Randall Prather's article on "Reproductive Biotechnology" (*Perspectives*, Sept. 1988) overextends the Genesis cultural mandate by making a case for human application of such technology, and as a justification uses scripture which is somewhat misapplied. Christians are called to be the proper stewards of God's creation, and while he has given man dominion over it, we are to use discretion in our management and use of the created world.

Reproductive biotechnology, as I see it, can only be used in the context of animal management and agriculture. Along those lines, I even consider myself to be in support of the use of recombinant DNA technology for bacterially mediated drug synthesis. The departure of Prather's logic and mine occurs in that he supports the view that reproductive biotechnology, on the genetic level, can have use in the human being.

Prather feels that this is a direction that we should move in and as a scriptural basis, misuses the Genesis 11:6 verse. He quotes: "for nothing will be withheld from them [man] which they have imagined to do." What Prather conveniently forgets to point out is that this is actually a reference to the construction of the tower of Babel, a point in Old Testament history where God judges mankind severely for our arrogant aspirations.

Christians, practicing good science, cannot be lending a hand to the development of technology that will inevitably be used to mold humanity in a way that flies in the face of God's natural design. While Christian researchers may have the intelligence to develop new technologies, unfortunately we do not corner the market on their use. Even though the NIH may be funding that area, we do not necessarily have to follow, taking for ourselves a lesson from the horse who is led to water.

Many technologies have been developed at points where society as a whole has not been able to accept them. Prather makes mention of smallpox vaccine, but there is a world of difference between vaccines and reconfiguring human genetics. Unfortunately a seeming "pay later" attitude exists in the research community, and it has led to technology which outpaces social, philosophical, and moral considerations. Surrogate motherhood, selective abortions, and fetal tissue transplanting are just some of the technological advances that have compromised our morals. I submit that human reproductive biotechnology is yet another one of these.

Finally Prather's use of Romans 8:28 as a catch-all justification for ill conceived research ignores what God has placed us here to do. Many times I have thought of the possible benefits of reproductive

biotechnology, but here it is clear that the ends would not justify the means. If God were to allow us to toy with his creation in this way, He would most certainly the owe the builders of Babel an apology.

Christopher Toombs
Graduate Student in Physiology
Bowman Gray School of Medicine
Wake Forest University
300 South Hawthorne Road
Winston-Salem, NC 27103

Paluxy Mantracks Still Affirmed

I found the article "The Rise and Fall of the Paluxy Mantracks" in the Sept. ASA Journal (v. 40, no. 3) most timely, especially the statement that it is "improper for creationists to continue to use the Paluxy data as evidence against evolution" (p. 151). The very Sunday (September 25th) before receiving the Journal issue, my husband and I attended a Sunday School class entitled "Scripture in the Light of Science: A Study of Genesis 1–11" at an evangelical church we have been visiting for the last few months. In that class, the creationist-teacher (a graduate of the Summer Institute on Scientific Creationism conducted by the Institute for Creation Research) cited human footprints being found next to dinosaur tracks in Texas as being evidence for the co-existence of man and dinosaurs. When I interrupted and pointed out recent articles to the contrary and how I had read that even the Creation Institute had backed down on this point, the teacher mumbled something about "some kind of staining on the tracks . . . we are still looking into that . . . " and went on with a presentation culminating in a statement that the "evidence points overwhelmingly to a young earth."

Could it be that the "cover-up" is still continuing?

Carol A. Hill
Geologist

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Robert L. Herrmann, Executive Director
Filed September 26, 1988

Once the rise of technology meant an improvement in humanity's life. Now human lives are dedicated en masse to the advancement and improvement of the technological machinery of progress. Left unhindered in its development and unquestioned in its purpose, technology has flourished, while the importance of the person has declined proportionately. People have become cogs in the machine, investments in the future, commodities to be bought and sold in the burgeoning marketplace; they are the functionaries of progress, and the servants of technology. Abundance and the constant drive for success are blessed, while gentleness, compassion, and contemplation have been forgotten.

Mark O. Hatfield
Between a Rock and a Hard Place, Word, Waco, Texas (1976), p. 157

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